Management Plan for Antarctic Specially Protected Area (ASPA) No.138 LINNAEUS TERRACE, ASGARD RANGE, VICTORIA LAND (161° 05' E, 77° 35' 50" S)

1. Description of values to be protected

Linnaeus Terrace was originally designated in Recommendation XIII-8 (1985, SSSI No. 19) after a proposal by the United States of America on the grounds that the Area is one of the richest known localities for the cryptoendolithic communities that colonize the Beacon Sandstone. Exposed surfaces of the Beacon Sandstone are the habitat of cryptoendolithic microorganisms, which may colonize a zone of up to 10 millimeters deep below the surface of the rocks. The sandstones exhibit a range of biological and physical weathering forms, as well as trace fossils, and many of the formations are fragile and vulnerable to disturbance and destruction by trampling and sampling. Cryptoendolithic communities are known to develop over time periods in the order of tens of thousands of years, and damaged rock surfaces would be slow to recolonize. The excellent examples of these communities found at the site are the subject of the original detailed Antarctic cryptoendolithic descriptions. As such, Linnaeus Terrace is considered a type locality with outstanding scientific values related to this ecosystem. These values, as well as the vulnerability of the site to disturbance and destruction, require that it receives long-term special protection. The Management Plan has been updated to include additional provisions to reduce the risk of alien plants, animals or microbes from other Antarctic sites, or from regions outside Antarctica.

2. Aims and objectives

Management at Linnaeus Terrace aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- allow scientific research on the ecosystem, in particular on the cryptoendolithic communities, while ensuring protection from excessive sampling, damage to fragile rock formations, or other possible scientific impacts;
- allow other scientific research provided it will not jeopardize the values of the Area;
- minimize the possibility of introduction of alien plants, animals and microbes into the Area;
- allow visits for management purposes in support of the aims of the management plan.

3. Management activities

- A copy of this management plan shall be kept available in appropriate places, in particular at McMurdo Station and Scott Base;
- Durable wind direction indicators should be erected close to the designated helicopter landing site whenever it is anticipated there will be a number of landings at the Area in a given season. These should be replaced as needed and removed when no longer required;
- 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 designated helicopter landing site;
- Markers 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;
- Visits shall be made as necessary (preferably no less than once every five years) to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate;

- National Antarctic Programmes operating in the region shall consult together for the purpose of ensuring these steps are carried out.

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

Map 1: ASPA No. 138 Linnaeus Terrace, Wright and Taylor Valleys.

Projection: Lambert conformal conic; Standard parallels: 1st 77° 30' S; 2nd 77° 40' S; Central Meridian: 161° 53' E; Latitude of Origin: 78° 00'.S; Spheroid: WGS84; Datum: 'Camp Area' Local; Contour interval 250 m.

Map 2: ASPA No. 138_Linnaeus Terrace, topography and boundary. Projection: Lambert conformal conic; Standard parallels: 1st 77° 35' S; 2nd 77° 36' S; Central Meridian: 161° 05' E; Latitude of Origin: 78° 00' S; Spheroid and horizontal datum: WGS84; Contour interval 5 m. Map derived from an orthophotograph with an estimated positional accuracy of 0.5m.

Figure 1: Photograph illustrating some of the fragile rock formations and trace fossils found on Linnaeus Terrace.

6. Description of the Area

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

Linnaeus Terrace (161° 05' 00" E, 77° 35' 50" S) is a bench of weathered Beacon Sandstone approximately 1.5 km in length and 1 km in width at an elevation of about 1600 m (Map 1). It is located at the western end of the Asgard Range, 1.5 km north of Oliver Peak (161° 02' 30"E, 77° 36' 40" S, 2410 m). The Area overlooks the South Fork of the Wright Valley, is about 4 km from Don Juan Pond and 10 km from the terminus of the Wright Upper Glacier (Map 1).

The lower (northern) boundary of the Area is characterized by the presence of a predominantly sandstone outcrop of approximately 3 m in height which extends for much of the length of the terrace (Map 2). The lower boundary of the Area is defined as the upper edge of this outcrop, and as straight lines adjoining the visible edges where the outcrop is covered by surface talus. The upper (southwestern) boundary of the Area is characterized by a line of sandstone outcrop of about 2-5 m in height, occurring between the elevations of 1660 - 1700 m about 70 m above the general elevation of the terrace. The upper boundary of the Area is defined as the uppermost edge of this outcrop, and shall be considered a straight line between the visible edges where the outcrop is covered by surface talus. The western end of the Area is defined as where the terrace narrows and merges with a dolerite talus slope on the flank of the NW ridge of Oliver Peak. The boundary at the west dips steeply from where the upper outcrop disappears, following the border of the dolerite talus with the terrace sandstone down to the westernmost corner. The east boundary is defined as the 1615 m contour, which follows closely the edge of an outcrop which extends much of the width of the terrace (Map 2). At the southernmost corner of the Area the terrace merges with the slopes into the valley to the east: from this point the boundary extends upward to the 1700 m contour, from where it follows the line of outcrop defining the southwestern boundary.

Winter air temperature at Linnaeus Terrace ranges between -20°C and -45°C, while in January the daily mean is approximately -5°C. Cryptoendolithic microorganisms typically colonize porous Beacon sandstones with a 0.2 - 0.5 mm grain size, with an apparent preference for rocks stained tan or brown by Fe3+ - containing oxyhydroxides. A silicified crust of about 1 mm thickness on many of the rocks probably facilitates colonization by stabilizing the surface and reducing wind erosion. Three of the five described cryptoendolithic microbial communities have been found on Linnaeus Terrace: the Lichen Dominated, Red-Gloeocapsa and Chroococcidiopsis Communities. Linnaeus Terrace is the type locality of the endemic green algal genus *Hemichloris* and of the endemic Xanthophycean algal species *Heterococcus endolithicus*. The

Area is unusual in that so many different living and fossil endolithic communities are present within a small area. The main physical and biological features of these communities and their habitat are described in Friedmann, E.I. (ed) 1993 *Antarctic Microbiology*, Wiley-Liss, New York.

Fragile weathered rock formations, such as trace fossils in eroded sandstone and brittle overhanging low rock ledges (ranging from approximately 10 cm up to 1 m in height), are present throughout the Area.

A small area (Map 2) has been contaminated by release of the C(14) radioactive isotope. While the contamination poses no significant human or environmental threat, any samples gathered within this area are considered unsuitable for scientific work using C(14) techniques.

6(ii) Restricted zones within the Area

None.

6(iii) Structures within the Area

A number of rocks within the Area have small instruments installed into them for scientific purposes and should not be disturbed.

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

Linnaeus Terrace lies within Antarctic Specially Managed Area (ASMA) No.2, McMurdo Dry Valleys. Within the ASMA, the nearest Special Feature is Don Juan Pond in the Upper Wright Valley. The nearest protected areas to Linnaeus Terrace are Barwick and Balham Valleys (ASPA No.123), 35 km to the north, and Canada Glacier (ASPA No.131), 50 km to the east (Map 1).

7. Permit conditions

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

- it is issued only for scientific study of the cryptoendolithic ecosystem, or for a compelling scientific or management purpose that cannot be served elsewhere;
- the actions permitted will not jeopardize the natural ecological or scientific values of the Area;
- any management activities are in support of the objectives of the Management Plan;
- the actions permitted are in accordance with the Management Plan;
- the permit, or a copy, shall be carried within the Area;
- a visit report is supplied to the authority named in the Permit;
- permits shall be issued for a stated period.

7 (i) Access to and movement within the Area

- Access to the Area is permitted by foot or by helicopter. No special restrictions apply to the routes used to move to and from the Area;
- Helicopters shall land only at the designated site at the west end of the terrace (161° 04' 29" E, 77° 35' 50" S, elevation 1610 m: Map 2), except when specifically authorized by Permit otherwise for a compelling scientific or management purpose. Use of helicopter smoke grenades is prohibited unless absolutely necessary for safety, and all grenades should be retrieved;
- When transporting permitted visitors, pilots, air crew, or passengers en route elsewhere on helicopters are prohibited from moving on foot beyond the immediate vicinity of the designated landing and camping sites unless specifically authorized by a Permit;
- Land vehicles are prohibited within the Area;
- Movement within the Area should avoid damage to fragile rock formations: care should be exercised to avoid walking on trace fossils (Figure 1) and brittle overhanging low rock ledges which are easily broken;

- Pedestrian traffic should be kept to the minimum necessary consistent with the objectives of any permitted activities.

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

- Scientific research which will not jeopardize the ecosystem of the Area;
- Essential management activities, including monitoring.

7(iii) Installation, modification or removal of structures

- No structures are to be erected within the Area except as specified in a permit;
- Permanent structures are prohibited;
- All scientific equipment installed in the Area must be authorized by permit and clearly identified by country, name of the principal investigator and year of installation. All such items should be made of materials that pose minimal risk of contamination of the Area;
- Removal of specific 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(iv) Location of field camps

Camping is permitted within the Area only at the designated site in the immediate vicinity of the helicopter landing site (Map 2).

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

- To avoid compromising the microbial ecosystem for which this site is protected, no living animals, plant material or microorganisms shall be deliberately introduced into the Area and the precautions listed below shall be taken against accidental introductions.
- To help maintain the ecological and scientific values of the Area, visitors shall take special precautions against the introduction of animals, plant material or microorganisms. Of particular concern are microbial and vegetation introductions from soils at other Antarctic sites, including stations, or from regions outside Antarctica. To minimize the risk of introductions, visitors should thoroughly clean footwear and any equipment to be used in the Area – particularly sampling equipment and markers – before entering the Area.
- No herbicides or pesticides shall be brought into the Area.
- Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the permit, shall be removed from the Area at or before the conclusion of the activity for which the Permit was granted.
- Food, fuel, and other materials are not to be stored in the Area, unless required for essential purposes connected with the activity for which the permit has been granted.
- All materials introduced shall be for a stated period only, shall be removed at or before the conclusion of that stated period, and shall be stored and handled so that risk of 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(vi) Taking or harmful interference with native flora or fauna

Taking or harmful interference with native flora or fauna is prohibited, except in accordance with a separate permit issued under Article 3 of Annex II by an appropriate national authority.

7(vii) Collection or removal of anything 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 management needs;

- Material of human origin, not brought into the Area by the permit holder, but which is likely to compromise the values of the Area may be removed from 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.

7(viii) Disposal of waste

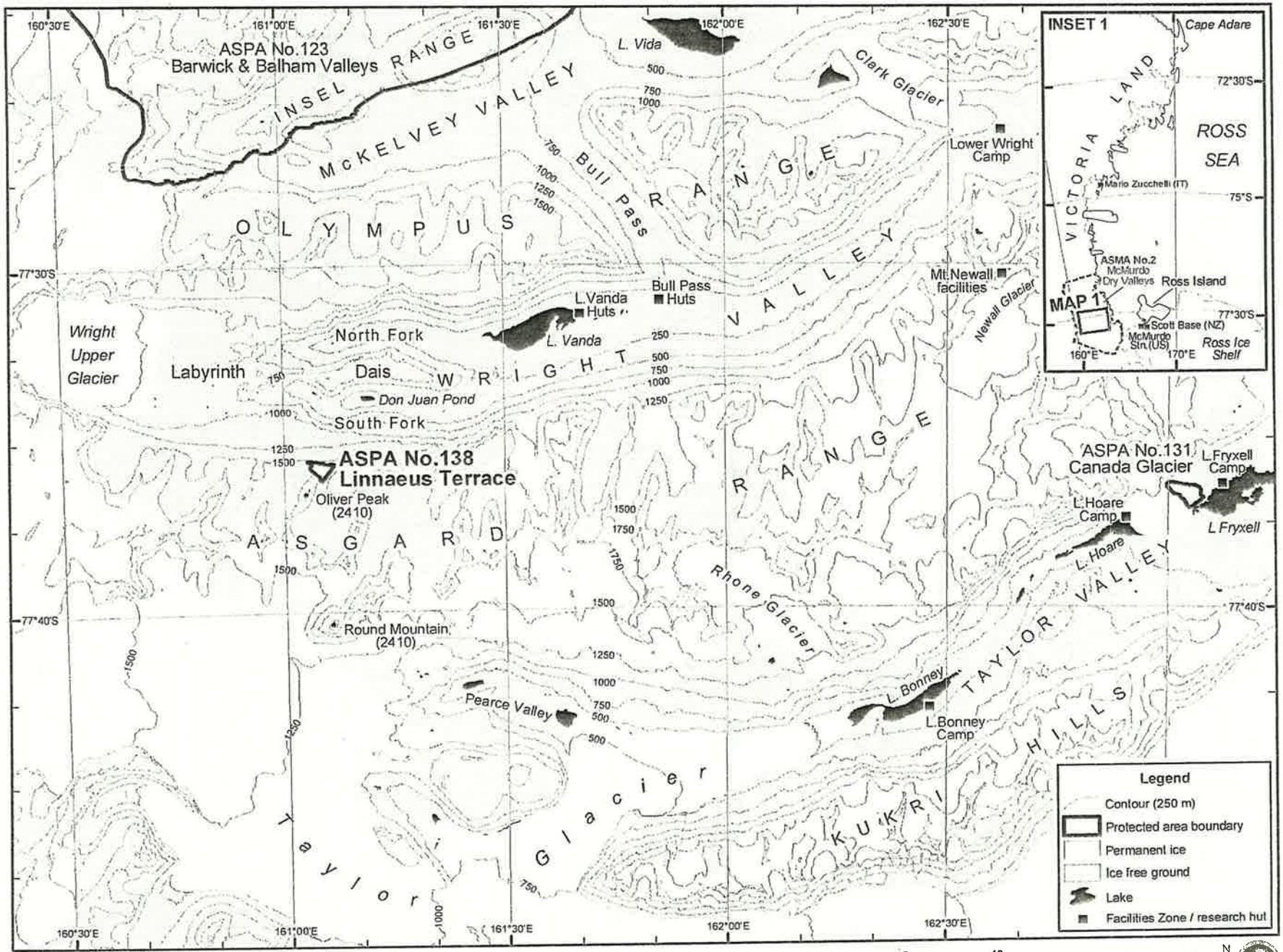
All wastes, including all human wastes, shall be removed from the Area.

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

- Visitors should consult and apply where appropriate the comprehensive Code of Conduct and *Guidelines for Conduct of Scientific Research* developed for use within the McMurdo Dry Valleys (ASMA No. 2).
- Any specific sites of long-term monitoring should be appropriately marked.

7(x) Requirements for reports

- Parties should ensure that the principal holder of each permit issued submit to the appropriate authority a report describing the activities undertaken. Such report should include, as appropriate, the information identified in the Visit Report form contained in Appendix 4 of Resolution 2 (1998)(CEP I).
- Parties should maintain a record of such activities, and, in the annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, in sufficient detail to allow evaluation of the effectiveness of the Management Plan. Parties should, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be used both in any review of the Management Plan and in organizing the scientific use of the Area.
- The appropriate authority should be notified of any activities/measures undertaken, and / or of any materials released and not removed, that were not included in the authorized permit.



Projection: Lambert Conformal Conic
CM 161 53', SP1 77 30', SP2 77 40', LO 78 . Spheroid: WGS84.
Datum: 'Camp Area' Local. Contour interval: 250 m. Heights in meters.
Data sources: USGS 1:50,000 Series (1970)
ASMA No.2 McMurdo Dry Valleys management plan

ASPA No. 138: Linnaeus Terrace
Map 1: Wright and Taylor Valleys

0 5 10
Kilometers

13 April 2008
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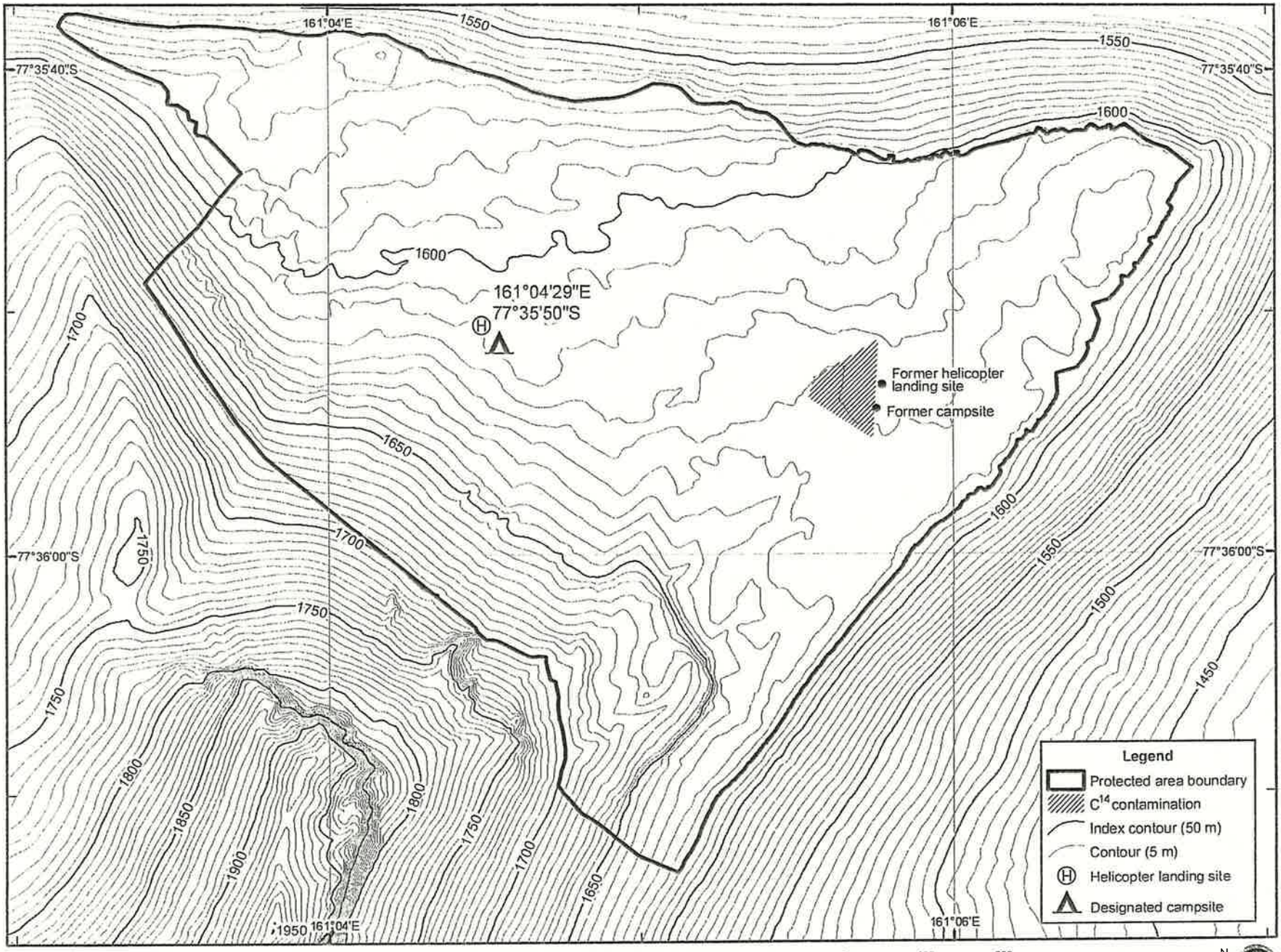
Environmental Research & Assessment



Projection: Lambert Conformal Conic
CM 161 15', SP1 77 35', SP2 77 36', LO 78
Spheroid and horizontal datum: WGS84. Contour interval: 5 m.
Data sources: Contours and ground features supplied by Gateway Antarctica.

ASPA No. 138: Linnaeus Terrace
Map 2: Topography and boundary

0 100 200
Meters

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