

Antarctic Specially Protected Area No. 131 (Site of Special Scientific Interest No. 12)

Canada Glacier, Taylor Valley, Victoria Land

1. Description of values to be protected

An area of 1 km² to the east side of Canada Glacier was originally designated in Recommendation XIII-8 (1985, SSSI No. 12) after a proposal by New Zealand on the grounds that it contains some of the richest plant growth (bryophytes and algae) in the southern Victoria Land Dry Valleys. As such, the Area is of exceptional intrinsic ecological value, and is also of scientific value to botanists, zoologists and microbiologists. The Area is designated primarily to protect the site's ecological values. It is also valuable as a reference site for other dry valley ecosystems. The boundaries of this site have been changed such that the Area now includes biologically rich communities that were previously excluded. The Area, located at an elevation of between 20 and 220 m, comprises gently to moderately sloping ice-free ground with summer ponds and small meltwater streams draining from the Canada Glacier to Lake Fryxell. Most of the plant growth occurs in a flush area close to the glacier in the central part of the Area. The composition and distribution of the plant communities in the Area are correlated closely with the water regime. Thus, water courses and water quality are important to the values of the site. The Area is unusual in that it receives higher levels of moisture compared with other parts of the south Victoria Land Dry Valleys, and is sheltered from strong winds by the nearby 20 m glacier face.

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

The Area requires long-term special protection because of its exceptional moss communities for the south Victoria Land Dry Valleys and thus ecological importance; its scientific values; the limited geographical extent of the ecosystem; the vulnerability of the Area to disturbance through trampling, sampling, pollution or alien introductions; and in view of the existing and increasing pressure from scientific, logistic and tourist activities in the region.

2. Aims and objectives

Management at Canada Glacier aims to:

- avoid degradation of, or substantial risk to, the values of the Area by preventing unnecessary human disturbance to the Area;
- allow scientific research on the ecosystem and elements of the ecosystem in particular moss communities while ensuring protection from over-sampling;
- allow other scientific research provided it is for compelling reasons;
- which cannot be served elsewhere;

- minimise the possibility of introduction of alien plants, animals and microbes to the Area;
- allow visits for management purposes in support of the aims of the management plan.

3. Management Activities

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

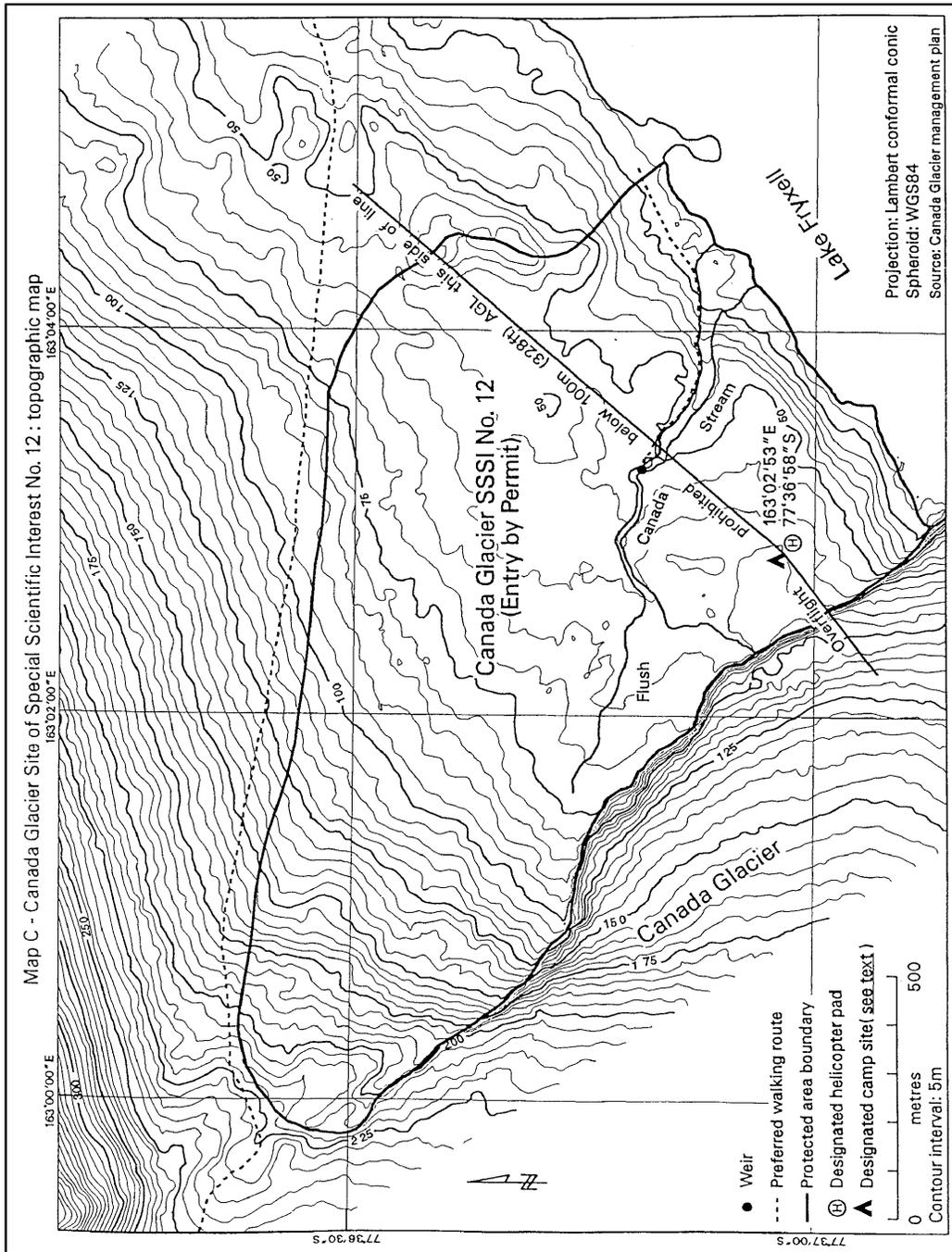
- Signs illustrating the location and boundaries with clear statements of entry restrictions shall be placed at appropriate locations at the boundaries of the Area to help avoid inadvertent entry.
- Signs showing the location of the Area (stating the special restrictions that apply) shall be displayed prominently, and a copy of this Management Plan shall be kept available, in all of the research hut facilities located in the Taylor Valley that are within 20 km of the Area.
- Brightly coloured markers, clearly visible from the air and posing no significant threat to the environment, shall be placed to mark the helicopter landing pad.
- Durable wind direction indicators should be erected close to the designated helicopter landing site. These should be replaced as needed and removed when no longer required.
- Markers, signs or structures erected within the Area for scientific or management purposes shall be secured and maintained in good condition.
- Visits shall be made as necessary (no less than once every five years) to assess whether the Area continues to serve the purposes for which it was designated and to ensure management and maintenance measures are adequate.
- National Antarctic Programmes operating in the region shall consult together with a view to ensuring these steps are carried out.

4. Period of Designation

Designated for an indefinite period.

Map B:

Canada Glacier, topographic map. Map specifications are the same as those for Map A. Contours are derived from the digital elevation model used to generate the orthophotograph in Map D. Precise area of moist ground associated with the flush is subject to variation seasonally and inter-annually.



ASPA 131
 Map B*

6. Description of the Area

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

The designated Area encompasses most of the glacier forefield area on the east side of the lower Canada Glacier, on the north shore of Lake Fryxell (77°37'S, 163°03'E: Maps A and B). The south boundary of the Area is defined as the shoreline of Lake Fryxell, to the water's edge, extending about 1 km east from where the Canada Glacier toe meets Lake Fryxell. The west boundary of the Area follows the edge of the Canada Glacier. The SE corner is near the neck of a small peninsula extending into L. Fryxell. The peninsula, outside of the Area, is marked by a large rock (split) surrounded by a circle of rocks which was a benchmark for the 1985 NZ survey of the original SSSI. A wooden post marking Dry Valley Drilling Project Site 7 (1973) is about 10 m to the NW of this point. A moraine ridge extends from the SE corner upward and in a northerly direction: this ridge defines the eastern boundary of the Area. The ridge dips sharply before joining the featureless slope of the main Taylor Valley wall: the NE corner of the Area is in this dip and will be marked by a cairn. A cairn will also be placed on a knoll on the ridge 450 m from the SE corner point.

Above the central flush a slope of lateral moraine of fairly even gradient extends upward and parallel to the glacier for about 1 km. At the top of this slope is a small knoll (220 m) about 300 m from where the glacier emerges into the Taylor Valley: a cairn and signpost will mark the boundary of the Area at this point. The upper, northern, boundary of the Area extends from the Canada Glacier to the boundary markers on the knoll and thence declines in elevation in an easterly direction for 1.7 km to the NE boundary cairn. The broad area above this upper boundary - outside of the Area - serves as an access 'corridor' between L. Fryxell and L. Hoare.

The central flush area (Maps C and D) containing the richest stands of vegetation is close to the glacier edge, near a small, shallow pond. The flush area is gently sloping and very moist with numerous small ponds and rivulets in the summer. The slopes above this area are better drained, but vegetation colonises several small stream channels which extend parallel to the glacier from the upper boundary of the Area down to the flush. Undulating moraines assist accumulation of persistent snow patches on this slope, which may also provide moisture for plant growth. Stream channels, and associated vegetation, become less obvious with distance from the glacier. These slopes and the central flush are drained to the SE by Canada Stream, one of three streams which dominate the water input to Lake Fryxell. In the 1990-91 season Canada Stream had a maximum streamflow of 0.65 m³s⁻¹ with a peak daily mean flow of 0.34 m³s⁻¹, both occurring in December.

Three moss species have been identified from the flush area: *Bryum argenteum*, *Bryum pseudotriquetrum* and *Pottia heimii*. Lichen growth in the Area is inconspicuous, but two epilithic lichens, *Carbonea capsulata* and an unknown species of *Sarcogyne*, and *Lecanora expectans* and *Caloplaca citrina* may be found in a small area near the outflow of the pond near Canada Glacier. Chasmoendolithic lichens occur in many boulders. Over 37 species of freshwater algae have been described at the site, predominantly from the Cyanophyta. The upper part of Canada

Stream superficially appears sparse in algal growth. However, abundant encrusting epilithophytes grow on the undersides of stones and boulders. Two algae, *Prasiola calophylla* and *Chamaesiphon subglobosus*, have been observed only in this upper part of the stream. Cyanobacterial mats are extensive in the middle and lower reaches of the stream. Mucilaginous colonies of *Nostoc commune* dominate wetter parts of the central flush, while oscillatoriacean felts cover much of the mineral fines. Epiphytic algae, dominated by *Nostoc*, are common over the surface of *Bryum argenteum* and *Pottia heimii*. The lower stream is similar in floral composition, although it is notable in that the alga *Tribonema elegans* is abundant while absent further upstream: this is the first record of this alga from Antarctica. *Phormidium* and *Gloeocapsa* species are common throughout the stream-course.

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

Evidence of human activities is commonplace within the Area. The main forms of damage evident at sites of vegetation are paths and footprints, removal of core samples from bryophyte turfs, and removal of larger clumps of bryophyte turfs. A number of old markers exist in the flush area and there has been some site modification closeby in the form of small rock dams, soil pits and several old campsites - much of this was remediated in the 1995-96 season. A plastic greenhouse was erected within the Area close to the flush in 1979 for experimental growth of garden vegetables, but this was destroyed in 1983 by a winter storm. Remains of the greenhouse found in the Area have been removed.

6(ii) Restricted zones within the Area
None.

6(iii) Structures within and near the Area

The first New Zealand hut at Canada Glacier was relocated to a second site in 1989, and removed completely in 1995-96. The second site is now designated for essential camping associated with research, marked on Maps C and D. Paths marked by lines of rocks, areas cleared for use as campsites, an old helicopter pad, and several low rock structures associated with the first hut site have nosier been remediated. A series of at least four shallow pits (~1 m in depth) were dug close to the old hut site. The second hut site comprised two small buildings, several new campsites, and a new helicopter pad. A path exists between the site and the glacier edge, crossing a moist area of plant growth. The helicopter pad remains as the current designated landing site.

A rock weir had been constructed in the constricted part of Canada Stream prior to 1981; in 1990 a more substantial weir and 9-inch Parshall flume were installed nearby (Maps C and D). The flume is made of black fibreglass. The weir consists of polyester sandbags filled with alluvium from near the stream channel: areas disturbed during construction were restored and after one season were not evident.

The upstream side of the weir is lined with vinyl-coated nylon. A notch has been built into the weir for relief in case of high flow. Clearance of seasonal snow from the channel has been necessary to prevent water from backing up at the weir. Data logging instrumentation and batteries are stored in a plywood crate located nearby on the north side of the stream.

Signposts and cairns mark the Area boundaries.

The US Fryxell Hut (20 m ASL) is located 1.5 km to the east, and Hoare Hut (65 m ASL) is located 3 km to the west of the Area (Maps A and B).

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

The nearest protected areas to Canada Glacier are Linnaeus Terrace (SSSI-19) 47 km west in the Wright Valley, and Barwick Valley (SSSI-3) 50 km to the NW (Inset, Map A).

7. Permit Conditions

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

- it is issued only for scientific study of the ecosystem, or for compelling scientific reasons that cannot be served elsewhere, or for essential management purposes consistent with plan objectives such as inspection or review;
- the actions permitted will not jeopardise the ecological or scientific values of the Area;
- any management activities are in support of the aims of the Management Plan;
- the actions permitted are in accordance with the Management Plan;
- the Permit, or an authorized copy, shall be carried within the Area;
- a visit report shall be supplied to the authority named in the Permit;
- permits shall be issued for a stated period.

7(i) Access to and movement within the Area

Vehicles are prohibited within the Area and access shall be by foot or by helicopter. Helicopter access should be from south of the line marked on the accompanying site maps, and overflight within the Area less than 100 m Above Ground Level (AGL) north of this line is prohibited. Helicopters shall land only at the designated site (163°02' 53" E, 77°36' 58" S: Map B) and overflight of the Area should generally be avoided. Exceptions to these flight restrictions, which will only be granted for an exceptional scientific or management purpose, must be specifically authorized by Permit. Use of helicopter smoke grenades within the Area is prohibited unless absolutely necessary for safety, and then these should be retrieved. Visitors, pilots, air crew, or passengers en route elsewhere on helicopters, are prohibited from moving on foot beyond the immediate vicinity of the designated landing and camping site unless specifically authorised by a Permit.

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

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

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

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

7(iii) Installation, modification or removal of structures

Any structures erected or scientific equipment installed within the Area are to be specified in a Permit. Scientific equipment shall be 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 a condition of the Permit.

7(iv) Location of field camps

Nearby permanent camps outside of the Area should be used as a base for work in the Area. Camping at the designated campsite (Maps B and C) may be permitted to meet specific essential scientific or management needs.

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

No living animals, plant material or microorganisms shall be deliberately introduced into the Area and precautions shall be taken against accidental introductions. No herbicides or pesticides shall be brought into the Area. Any other chemicals, including radio-nuclides or stable isotopes, which may be introduced for scientific or management purposes specified in the Permit, shall be removed from the Area at or before the conclusion of the activity for which the Permit was granted. Fuel is 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 minimised.

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

This is prohibited, except in accordance with a Permit. 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(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 scientific or management needs. Material of human origin likely to compromise the values of the Area, which was not brought into the Area by the Permit Holder or otherwise authorised, may be removed unless the impact of removal is likely to be greater than leaving the material in situ: if this is the case the appropriate authority should be notified.

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

1. Permits may be granted to enter the Area to carry out biological monitoring and site inspection activities, which may involve the collection of small samples for analysis or review, to erect or maintain signposts, or for protective measures.
2. Any specific sites of long-term monitoring shall be appropriately marked.
3. To help maintain the ecological and scientific values of the plant communities found at the Area visitors shall take special precautions against introductions. Of particular concern are microbial or vegetation introductions sourced from soils at other Antarctic sites, including stations, or from regions outside Antarctica. To minimise the risk of introductions, visitors shall thoroughly clean footwear and any equipment to be used in the area - particularly camping and sampling equipment and markers - before entering the Area.

7(x) Requirements for reports

Parties should ensure that the principal holder for each permit issued submit to the appropriate authority a report describing the activities undertaken. Such reports should include, as appropriate, the information identified in the Visit Report form suggested by SCAR. Parties should maintain a record of such activities and, in the annual Exchange of Information, should provide summary descriptions of activities conducted by persons subject to their jurisdiction, which should be in sufficient detail to allow evaluation of the effectiveness of the Management Plan. Parties should, wherever possible, deposit originals or copies of such original reports in a publicly accessible archive to maintain a record of usage, to be used both in any review of the management plan and in organising the scientific use of the Area.