Management Plan for
Antarctic Specially Managed Area No. 2

MCMURDO DRY VALLEYS, SOUTHERN VICTORIA LAND

1. Description of values to be protected and activities to be managed

The McMurdo Dry Valleys are characterized as the largest relatively ice-free region in Antarctica with approximately thirty percent of the ground surface largely free of snow and ice. The region encompasses a cold desert ecosystem, whose climate is not only cold and extremely arid (in the Wright Valley the mean annual temperature is –19.8°C and annual precipitation is less than 100 mm water equivalent), but also windy. The landscape of the Area contains glaciers, mountain ranges, ice-covered lakes, meltwater streams, arid patterned soils and permafrost, sand dunes, and interconnected watershed systems. These watersheds have a regional influence on the McMurdo Sound marine ecosystem. The Area's location, where large-scale seasonal shifts in the water phase occur, is of great importance to the study of climate change. Through shifts in the ice-water balance over time, resulting in contraction and expansion of hydrological features and the accumulations of trace gases in ancient snow, the McMurdo Dry Valley terrain also contains records of past climate change. The extreme climate of the region serves as an important analogue for the conditions of ancient Earth and contemporary Mars, where such climate may have dominated the evolution of landscape and biota.

The Area is characterized by unique ecosystems of low biodiversity and reduced food web complexity. However, as the largest ice-free region in Antarctica, the McMurdo Dry Valleys also contain relatively diverse habitats compared with other ice-free areas. The Area contains unusual microhabitats and biological communities (such as endolithic and Cryoconite systems) as well as special geological features and minerals (for example, salt deposits and desert pavements). Some of these special geological features are of value because they contain an extremely long record of natural events. The long-term data sets for environmental observations that have been collected in this region are some of the longest in Antarctica. The McMurdo Dry Valleys contain indicators of past and present regional climate change, as well as features that play a role in influencing local climate change.

These scientific values are also of global as well as regional importance. The Area is a valuable resource for understanding landscape processes and the stability of Antarctic ice sheets. The McMurdo Dry Valleys contain unique surface deposits including glacially deposited and modified sediments, sand dunes, desert pavement, glacio-lacustrine sediments, and marine fjord sediments containing valuable records of planetary change. The soil, rock, water, and ice environments and their associated biota are of scientific value as model ecosystems that allow deep insights into natural processes operating throughout the biosphere. Finally, the species that reside in the McMurdo Dry Valleys provide a biological resource for understanding adaptation to extreme environments, and are true end members of ecological continua.

The McMurdo Dry Valleys are also valued for their wilderness quality. They represent a nearly pristine environment largely undisturbed and uncontaminated by humans. The dramatic landscape, composed of high ridges and sweeping valleys, and contrasts of ice-free and glacier-covered terrain creates unique vistas with high aesthetic value.

Activities conducted in the area include a variety of scientific research, operations in support of science, media, arts, education and other official national programme visitors; and tourism. A Long Term Ecological Research site has been established in the Taylor Valley.

2. Aims and objectives

The Area requires special management to ensure that its scientific, wilderness, ecological, and aesthetic values are protected, including that data sets collected over the last 100 years will continue to be of high value.
Increasing human activity and potentially conflicting interests have made it is necessary to more effectively manage and coordinate activities within the Area. The overall aim is to manage and coordinate human activities in the Area such that the values of the McMurdo Dry Valleys are protected in the long term. The specific objectives of management in the Area are to:

- Facilitate scientific research while maintaining stewardship of the environment;
- Assist with the planning and coordination of human activities in the McMurdo Dry Valleys to manage conflicts among different values (including those of different scientific disciplines), activities and operators.
- Ensure the long-term protection of ecosystem integrity and special features through the minimization of cumulative environmental impacts of human activities;
- Minimize the possibility of the introduction of alien plants, animals and microbes to the Area;
- Promote the use of transportation modes that have the least environmental impact;
- Minimize the use of fossil fuels for the conduct of activities in the Area;
- Minimize the footprint of all facilities and scientific experiments established in the Area, including the proliferation of field camps.

3. Management activities

The following management activities are to be undertaken to achieve the aims and objectives of this plan:

- National Programs active within the Area should establish a McMurdo Dry Valleys Management Group to oversee coordination of activities in the ASMA. The Management Group is established to ensure effective communication among those parties active in the Area, to provide a forum to resolve any potential conflicts in uses, to minimize the duplication of activities, and to evaluate the effectiveness of management activities. This group should convene on an annual basis to review past, existing, and future activities and make recommendations on the implementation of this Management Plan.
- National Programs operating in the Area shall promote the dissemination of information to all parties operating in the Area to ensure the enforcement of the Management Plan.

- All operators in the Area shall ensure that all personnel in their programs visiting the Area have been briefed on the requirements of the Management Plan and in particular on the Environmental Code of Conduct that applies within the Area.

- Copies of this management plan together with the maps and appendices shall be kept in appropriate stations and research hut facilities and be made available to all persons in the Area.

- Tourism and any other non-governmental activities should be coordinated with National Programs operating in the Area.

- Visits shall be made as necessary (no less than once every five years) to evaluate whether the Management Plan is effective and to ensure management measures are adequate.

Note that guidelines for the conduct of specific activities and for specific zones within the Area are found in Appendices B, C, D, and E (also see section 7 of this Management Plan).

4. Period of designation

Designated for an indefinite period.

5. Maps and photographs

The following maps are included in the plan:

Map A: Map of the McMurdo Dry Valleys Area

Map B: Wright Valley and Taylor Valley Map

Map C: Lake Vanda Huts Facilities Zone

Map D: Lower Wright Camp Facilities Zone

Map E: Bull Pass Hut Facilities Zone

Map F: Cape Roberts Camp Facilities Zone

Map G: New Harbor Camp Facilities Zone

Map H: F-6 Camp Facilities Zone

Map I: Lake Fryxell Camp Facilities Zone

Map J: Lake Hoare Camp Facilities Zone

Map K: Lake Bonney Camp Facilities Zone

Map L: Marble Point Refueling Station Facilities Zone

Map M: Mt. Newall Facilities Zone

Map N: Canada Glacier Tourism Zone

6. Description of the Area

The McMurdo Dry Valleys are located in southern Victoria Land along the western coast of McMurdo Sound, southern Ross Sea, at approximately 77°S, 162°E. An area of approximately 15,000 km^2 is designated as an Antarctic Specially Managed Area (hereafter referred to as the "Area") to manage human activities in the valleys, for the protection of scientific, wilderness, ecological, and aesthetic values.

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

The Area boundaries have been defined primarily on the basis of the hydrological catchments in the McMurdo Dry Valleys, including all of the ice-free ground and adjacent areas within these catchments, all of the Convoy Range, and the catchment of the Alph River. Starting at the northwest corner and moving counter-clockwise, the boundary is delineated by the following features: the northwest tip of Allan Nunatak (76.7167ºS, 159.6667ºE), Carapace Nunatak (76.8833°S, 159.4°E), Mt. DeWitt (77.2°S, 159.8333°E), the western edge of Horseshoe Mountain (77.5667ºS, 159.95ºE), Depot Nunatak (77.75ºS, 160.0667ºE), the southern most peak of the Lashly Mountains (77.9606ºS, 159.5603ºE), Mt. Kempe (78.3167ºS, 162.7167ºE), the Pyramid (78.35ºS, 163.5ºE), the east side of Heald Island (78.25ºS, 163.8167ºE), DeMaster Point (off the eastern end of Marshall Valley, 78.0792ºS 164.4131º), north along the coast following the mean low tide level to the east side of Tripp Island (76.6333ºS, 162.7ºE), the southern edge of Fry Glacier (76.6333ºS, 162.3ºE), and, again the northwest tip of the Allan Nunatak (76.7167ºS, 159.6667ºE). Given the large size of the Area and the prominence of physical features that define the boundaries, boundary markers are not installed.

All geographic coordinates in this Management Plan are given in decimal degrees format.

6(ii) Restricted and managed zones within the Area

This Management Plan establishes three types of managed zones within the Area: Facilities Zones, a Tourism Zone, and Special Features. The objective of a zoning concept is to manage for multiple uses of and activities in the Area while providing protection for those features for which the Area is valued. The Facilities Zones are intended to contain primary areas of human activity, the Tourism Zone specifies the area where tourism activities may occur, and the Special Features are established to provide additional protection for environmental features of special value. Each zone, discussed in the sections below, has specific guidelines for the conduct of activities, found in Appendices C, D, and E.

6(ii)(a) Facilities Zones

Facilities Zones have been established to contain temporary and semi-permanent facilities within pre-defined areas and thereby control their distribution. Facilities Zones may be areas where human presence is intended to be semi-permanent or for a defined period of time in which significant activity is occurring. They may also be areas where human presence is expected to have regular occupation and/or repetitive activity. New Facilities Zones may need to be

established from time to time. The establishment of new Facilities Zones should be considered and coordinated by the Management Group, and should be designed to minimize the footprint of facilities and associated materials. The following management activities should be undertaken for Facilities Zones:

- Alternative energy sources and energy efficiency should be considered in the planning and maintenance of activities within the Facilities Zones;

- Waste management should be considered in the planning and maintenance of activities within the Facilities Zone;

- Facilities Zones should be periodically assessed for usefulness, improvement or removal;

- As appropriate, contingency plans for emergencies should be developed to take into account the special needs of specific Facilities Zones;

- Facilities Zones should not be located on or in close proximity to Special Features.

Facilities Zones are listed in Appendix C with locations, boundary descriptions, and guidelines for conduct in the Zones. Maps A, B, and C shows the location of the Facilities Zones, and Maps D-M show the individual Facilities Zones.

6(ii)(b) Tourism Zone

The Tourism Zone is located in an area of high aesthetic value near the Canada Glacier in the Taylor Valley, where safe and easy access and movement within the area can be reasonably assured with minimal impact to science activities or the environment. The site was established based on consultation among the national programs operating in the Area and the tourism industry. The site has received carefully managed visitation by tour parties in the past. Tourism activities should be restricted to this area.

Guidelines for the conduct of activities within the Tourism Zone are located in Appendix D, along with the location and boundary description of the Tourism Zone. Map N shows the location of the Tourism Zone.

6(ii)(c) Special Features

Special Features are designated areas which are of particularly high scientific value and which are particularly sensitive to human disturbance. For these reasons, Special Features require additional measures to ensure their protection. Special Features are listed in Appendix E with a brief description of their scientific importance, their locations, and guidelines for conduct. Map A shows the location of Special Features.

6(iii) Structures within and near the Area

The main structures in the Area are located within the Wright and Taylor valleys, at Marble Point, at Cape Roberts, and at Odell Glacier. There are three semi-permanent field camps in the Wright Valley, and five semi-permanent field camps in the Taylor Valley. Map A shows the location of all structures within the Area.

Table 1 summarises information about each of the sites containing structures in the Area, including the National Program maintaining each site, the geographic coordinates and location description of each site, and a description of the structures at each site including dimensions.

Table 1: Structures within the Area

Name	MP[1]	Geographic Location	Description of Location	Structures
Bull Pass Camp (or Lake Vanda Seismic Station)	US	77.5169°S, 161.8513°E	Along the north edge of the Wright Valley near the entrance to Bull Pass.	Two shelters located at this site, an equipment shelter and an environmental shelter approximately 28.7 sq. m. (290 sq. ft.) which houses a hybrid power system.
Cape Roberts Camp	NZ	77.0333°S, 163.2°E	The southern cape of Granite Harbor, on the coast.	Two huts on the ice-free area of Cape Roberts with accommodation for four people (approximately 10 sq. m.) as well a living hut 19 sq. m. (205 sq. ft.). A storage rack for drummed fuel is also at the site.
F-6 Camp	US	77.6083°S, 163.255°E	On the southeast end of Lake Fryxell across from the Commonwealth Glacier in the Taylor Valley.	A 42 sq. m. (448 sq. ft.) main building with outhouse adjacent.
Lake Bonney Camp	US	77.715°S, 162.555°E	On a steep slope on the south side of Lake Bonney in the Taylor Valley.	A 55.7 sq. m. (600 sq. ft.) Jamesway, a 2.2 sq. m. (24 sq. ft.) outhouse, an 8.9 sq. m. (96 sq. ft.) generator building, and three 8.9 sq. m. (96 sq. ft.) laboratories.
Lake Fryxell Camp	US	77.6067°S, 163.1217°E	Midway along Lake Fryxell on the north side of the lake in the Taylor Valley.	A 62.7 sq. m. (675 sq. ft.) Jamesway (main building), four 13.9 sq. m. (150 sq. ft.) laboratories, and one 13.9 sq. m. (150 sq. ft.) generator building.
Lake Hoare Camp	US	77.6233°S, 162.905°E	On the north side of Lake Hoare at the base of Canada Glacier in the Taylor Valley.	A 55.7 sq. m. (600 sq. ft.) main building, three 13.9 sq. m. (150 sq. ft.) labs, a generator building (96 sq. ft), a tool shed (96 sq. ft.), and three outhouses: two 2.2 sq. m. (24 sq. ft.) and one 1.7 sq. m. (18 sq. ft.). Below the active

[1] Maintaining party

				camp are the old Lake Hoare Camp buildings, which are still in use. These include a 37 sq. m. (400 sq. ft.) Jamesway used primarily for storage, a 6 sq. m. (64 sq. ft.) generator shed, and a 7.5 sq. m. (81 sq. ft.) old laboratory used as a shower room.
Lake Vanda Huts	NZ	77.5233°S, 161.6717°E	At the eastern end of Lake Vanda in the upper part of the Wright Valley.	Three interconnected huts with a total floor area of 30 sq. m. (323 sq. ft.).
Lower Wright Hut	NZ	77.4333°S, 162.6167°E	South of Lake Brownworth in the lower part of the Wright Valley.	One small hut with accommodation for 2 people with a floor area of 6 m. sq (65 sq. ft.).
Marble Point Refueling Station	US	77.413°S, 163.68°E	5 km (3 miles) north of Cape Bernacchi on the coast of Victoria Land, and approximately 60 km (37 miles) across McMurdo Sound from Cape Royds.	A 69.7 sq. m. (750 sq. ft.) main building, a 41.8 sq. m. (450 sq. ft.) bunkhouse, a 55.7 sq. m. (600 sq. ft.) bunkhouse, a 7.4 sq. m. (80 sq. ft.) fuel shack, 6 fuel storage tanks (25,000 gallons each), a 2.2 sq. m. (24 sq. ft.) outhouse and incinerator for solid waste, a 1.9 sq. m. (20 sq. ft.) storage shed, a 21 sq. m. (224 sq. ft.) generator shed, a 27 sq. m. (288 sq. ft.) workshop and storage building, and a 7 sq. m. (76 sq. ft.) ASOS weather station.
Mt. Newall Radio Repeater Site	US/ NZ	77.5049°S, 162.6221°E	On Mt. Newall, a peak in the northeast extremity of the Asgard Range (20 km (12 miles) east of Lake Vanda).	The site includes both a US and a NZ radio repeater. There are three huts on Mt. Newall, including an 8.9 sq. m. (96 sq. ft.) survival hut, a 22.3 sq. m. (240 sq. ft.) shed encompassing a hybrid power system (both US), and a green equipment shelter 2.2 sq. m. (24 sq. m.) housing the NZ repeater. US repeater equipment contained in two orange plastic cases. There are two antennae (one US, one NZ) and a wind turbine (US) at the site.
New Harbor	US	77.575°S,	At the far eastern	Main building consists of two

Camp		163.4983°E	end of the Taylor Valley, beside New Harbor Bay.	Jamesways connected by a wooden passageway, one 42 sq. m. (448 sq. ft.) and the other 30 sq. m. (320 sq. ft.). Adjacent to the main building are a 3 sq. m. (32 sq. ft.) storage shed and a 1.5 sq. m. (16 sq. ft.) outhouse. The camp also includes a 21 sq. m. (224 sq. ft.) Jamesway that serves as a laboratory, an 8.9 sq. m. (96 sq. ft.) generator shack, and a 1.5 sq. m. (16 sq. ft.) diving equipment storage box.
Odell Glacier Camp	US	76.6810°E, 159.9134°S	Beside the Allan Hills on the western edge of the Odell Glacier.	This two-person camp consists of one 8.9 sq. m. (96 sq. ft.) hut and includes a 5kw generator, a wind generator, a solar array, and a Scott tent.

There are a number of sites of scientific and operational instrumentation located throughout the Area, for example, automatic weather stations (AWSs), radio repeater sites, and glacier mass balance devices. There are also several sites in the McMurdo Dry Valleys where semi-permanent camps have been decommissioned and removed. These are shown in the Table 2.

Table 2: Known Sites of Decommissioned Semi-Permanent Camps in the Area

Decommissioned site	**Geographic coordinates**
Asgard Hut (NZ)	77.5833°S, 161.6°E
Brownworth Hut (NZ)	77.45°S, 162.8833°E
Bull Pass Hut (New Zealand)	77.5169°S, 161.8513°E
Meserve Glacier Camp (US)	77.5133°S, 162.2833°E
Miers Valley Hut (NZ)	78.1333°S, 163.8333°E
Old Lake Bonney Hut (US)	77.7033°S, 162.51°E
Lake Fryxell Hut (NZ)	77.6167°S, 163.05°E
Vanda Station (NZ)	77.5267°S, 161.6683°E
Commonwealth Glacier Camp (NZ)	77.5824°S, 163.5969°E
Old New Harbor Camp (US)	77.575°S, 163.4983°E

Seven sites in the Area were drilled as a part of the McMurdo Dry Valley Drilling Project carried out between 1971 and 1975. Drill sites for the program are located at Lake Vanda (DVDP 4) (drilled 85.8 m below ice surface), Don Juan Pond (DVDP 5) (3.4 m), Lake Vida (DVDP 6) (305.8 m), Lake Fryxell (DVDP 7) (11.1 m), New Harbor (DVDP 8 and 9) (157.5 m and 38.3 m, respectively), and Commonwealth Glacier.

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

There are four existing ASPAs within the Area. A permit is required for entry into these protected areas. They are:

ASPA 123, Barwick and BalhamValleys
ASPA 131, Canada Glacier

7. Code of Conduct

The Code of Conduct in this section is the main instrument for the management of activities in the Area. It outlines the overall management and operational principles for the Area.

In addition, further guidance is provided in the *Environmental Code of Conduct for the McMurdo Dry Valleys* (Appendix A). An earlier version of the *Environmental Code of Conduct* has already been adopted by the national Antarctic programs of New Zealand and the United States. It is important that all persons visiting the McMurdo Dry Valleys be aware of the guidelines outlined in the Appendix A before entering the Area.

7(i) Access to and movement within the Area

The Area is large and has numerous potential access points. Access to the Area is normally made by helicopter from Ross Island, or over sea ice via New Harbor or Marble Point. Designated helicopter pads should be used for helicopter landings. Where these are unavailable, previously used landing sites should be selected when possible. Where it is expected that helicopters will be used for repetitive access to a particular location, consideration should be given to establishing a designated site for landing. Such suggestions should be referred to the Management Group. Overflight restrictions are in place over ASPA No. 123 in the Barwick and Balham Valleys, ASPA No. 131 at Canada Glacier, and ASPA No. 154 at Botany Bay. Special provisions on overflight of and landing near Special Features may apply, and these are described in Appendix E, *Guidelines for Special Features.*

All pedestrian access routes and movement within the Area should be undertaken so as to minimize disturbance to the soil and vegetated surfaces. There are a number of walking routes in the Area. In the Taylor Valley, these include routes between F-6 Camp and Lake Fryxell Camp, F-6 Camp and Lake Hoare Camp, Lake Hoare Camp and Lake Fryxell Camp, and Lake Hoare Camp and Lake Bonney Camp. There is a route from the edge of Lake Fryxell to the weir at Canada Stream. There are also routes outside the immediate vicinity of F-6, Lake Fryxell, Lake Bonney, and Lake Hoare camps. In the Wright Valley, there is a route between the Vanda Weir and the Vanda Huts. There is a loosely defined route along the Onyx River between Lake Vanda and Lake Brownworth. In places, remnants of tracks from overland vehicles moving along the route in the 1970s remain.

The use of vehicles in the Area should be restricted to lake ice except where specifically authorised to do so, or at Marble Point, New Harbor, and Cape Roberts where vehicles should keep to existing vehicle tracks.

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

Activities which may be conducted in the area include scientific research; operations in support of science; media, arts, education or other official national program visitors; management activities including maintenance or removal of facilities; and tourism visits within the Tourism Zone, where these activities do not jeopardize the values of the area.

All activities in the McMurdo Dry Valleys should be conducted in such a manner as to minimize environmental impacts. Alternative energy sources (e.g. solar, wind, fuel cells) should be used as much as possible to minimize fossil fuel usage. Specific guidelines on the conduct of activities in the Area can be found in the Appendices.

Tourism activities should be undertaken so as to minimise as much as possible adverse impacts on the McMurdo Dry Valleys ecosystem and the scientific activities in the Area. Tour operators should provide visit schedules to National Programs operating in the Area in advance of their visits, which should be circulated to the Management Group. Tourism movements in the Area should avoid stream crossings. If streams must be crossed, designated crossing points including existing boulders should be used. Tourism activities should be confined to the designated Tourism Zone. Guidelines for conduct of activities in the Tourism Zone are outlined in Appendix D.

7(iii) Installation, modification, or removal of structures

Care should be exercised when locating and establishing installations to minimise their impact on the environment. Installation sites should be re-used to the greatest extent possible and the location recorded. The footprint of installations should be kept to the minimum practicable. No structures should be installed outside of Facilities Zones. The installation of new structures and establishment of new Facilities Zones should be considered by the Management Coordination Group.

7(iv) Field camps

In the McMurdo Dry Valleys, a field camp is considered to be a small (generally one or two tents), temporary camp set up for research in a field season. Field camps are generally remote from Facilities Zones. Care should be exercised when locating and establishing campsites to minimise their impact on the environment. Campsites should be re-used to the greatest extent possible and the location recorded. The footprint of campsites should be kept to the minimum practicable.

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

This is prohibited, except in accordance with a permit issued under Article 3 of Annex II of the Protocol on Environmental Protection. 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(vi) Collection or removal of material found in the Area

Material not covered by 7(v) above should only be collected or removed from the Area for scientific and associated educational purposes or essential management purposes and should be limited to the minimum necessary for those needs. Any meteorites taken are to be collected and curated according to accepted scientific standards, and are made available for scientific purposes. Material of human origin likely to compromise the values of the Area may be removed unless the impact of removal is likely to be greater than leaving the material in place. If this is the case the appropriate authority should be notified.

7(vii) Waste management

All materials taken into the Area should be collected and removed from the Area to the maximum extent practicable. Water used for any human purposes, including scientific purposes, should be removed and/or treated in a greywater evaporator (and residuals removed). All human wastes should be removed from the Area, including residues from incineration.

In accordance with Article 4, Annex III of the Protocol on Environmental Protection, wastes shall not be disposed of onto ice-free areas, into fresh water systems or onto snow or ice which terminate in such areas or have high ablation.

7(viii) Requirements for reports

Reports of activities in the Area should be maintained by the Management Group to the greatest extent possible, and made available to all parties.

In accordance with Article 10 of Annex V of the Protocol on Environmental Protection, arrangements shall be made for collection and exchange of reports of inspection visits and any significant changes or damage within the Area.

Tour operators should record their visits to the Area, including the number of visitors, dates, and incidents in the Area, and submit this data to the Management Coordination Group. Geographical coordinates for all field camps should be recorded. With regard to the special features, all visits and activities at the special features should be recorded and all sampling at the special features, including type and quantity, should be recorded.

8. Provisions for the exchange of information in advance of proposed activities

In addition to the normal exchange of information by means of the annual, national reports to the Parties of the Antarctic Treaty, and to SCAR and COMNAP, Parties operating in the Area should exchange information through the Management Coordination Group.

9. Supporting documentation

Publications

Vincent, W.F., ed. 1996. Environmental Management of A Cold Desert Ecosystem: The McMurdo Dry Valleys. Report of a National Science Foundation Workshop held at Santa Fe, New Mexico, 14-17 March 1995.

Wharton, R.A., ed. 1991. McMurdo Dry Valleys: A Cold Desert Ecosystem. Report of a National Science Foundation Workshop held at the Institute of Ecosystem Studies, The New York Botanical Garden, Millbrook, New York, 5-7 October 1991.

Wharton, R.A. and Doran, P.T., eds. 1998. McMurdo Dry Valley Lakes: Impacts of Research Activities. Report of a National Science Foundation Workshop held at the University of Illinois at Chicago, 15-17 July 1998.

Management Plans

Management Plan for Antarctic Specially Protected Area No. 123 Barwick and Balham Valleys, South Victoria Land

Management Plan for Antarctic Specially Protected Area No. 131 Canada Glacier, Taylor Valley, Victoria Land

Management Plan for Antarctic Specially Protected Area No. 138, Linnaeus Terrace, Asgaard Range, Victoria Land

Management Plan for Antarctic Specially Protected Area No. 154, Botany Bay, Cape Geology, Victoria Land

APPENDIX A:

Environmental Code of Conduct for the McMurdo Dry Valleys

Why are the McMurdo Dry Valleys considered to be so important? The McMurdo Dry Valleys ecosystem contains geological and biological features that date back thousands to millions of years. Many of these ancient features could be easily and irreversibly damaged by human actions. Unusual communities of microscopic life forms, low biodiversity, simple food webs with limited trophic competition, severe temperature stress, aridity and nutrient limitations are other characteristics that make the McMurdo Dry Valleys unique .This ancient desert landscape and its biological communities have very little natural ability to recover from disturbance. Research in such systems must aim to minimize impacts on land, water and ice to protect them for future generations.

Materials:

- Everything taken into the Area should be removed and returned to the appropriate national program station for proper handling.

- Activities that could result in the dispersal of foreign materials should be avoided (e.g. do not use spray paint to mark rocks) or should be conducted inside a hut or tent (e.g. all cutting, sawing and unpacking).

- Do not leave any travel equipment behind (e.g. ice screws, pitons).

Waste and spill incidents:

- Water used for ANY human purpose should be removed and/or treated in a greywater evaporator (and residuals removed).

- All human waste should be collected and removed.

- Individuals or groups should always carry proper containers for human waste and gray water so that they may be properly and safely transported and disposed.

- Spill incidents should be reported to the appropriate National Program.

- The location of any spill should be recorded in the group's field report.

Energy:

- Solar and wind power should be used as much as possible to minimize fuel usage.

Travel operations:

- Ground vehicle usage should be restricted to ice surfaces unless specifically authorized to do otherwise, or at Marble Point, Cape Roberts, and New Harbor.

- Designated helicopter pads should be used for helicopter landings. Where these are unavailable, known previous landing sites should be used when possible.

- Markers that are clearly visible from the air should be used to mark helicopter pads.
- Helicopter operations should not use smoke bombs, except for essential safety purposes.
- Care should be taken to ensure that helicopter sling loads are properly secured. Trained personnel should supervise these operations.
- Fuel release is to be avoided.
- When traveling on foot, stay on established trails whenever possible.
- Avoid walking on vegetated areas.
- Cairns should not be built in the Area.
- Be aware of Special Features and their guidelines.

Safety:

- Individuals or groups should bring sufficient equipment, survival or otherwise, into the Area to ensure safety.

Field camps: location and set up:

- Campsites should be located as far away as practical from lakeshores, streambeds, Special Features, and long-term experiments to avoid damage or contamination. Do not camp in streambeds, even if they are dry.
- Where rocks are moved for campsites or other activities, they should be replaced in their footprint if possible, and at minimum should be placed with the salt-encrusted side faced-down.
- Campsites should be re-used wherever possible.
- The location of field camps should be recorded in the group's field report.
- Ensure that equipment and supplies are properly secured at all times to avoid dispersion by high winds.

Fuel and chemicals:

- Steps should be taken to prevent the accidental release of chemicals including laboratory reagents and isotopes (stable or radioactive). Chemicals of all kinds should be dispensed over drip trays or other forms of containment. When permitted to use radioisotopes, safety and handling instructions should be followed precisely.
- When using chemicals or fuels, ensure that spill kits appropriate to the volume of the substance are available. Those working with chemicals and fuels should be familiar with their use and with appropriate spill response procedures.

- Chemical and fuel containers should be securely positioned and capped, particularly on lake ice.

- All fuel drums should be provided with some form of secondary containment.

- Fuel cans with spouts should be used when refueling generators. Generators and vehicles should be refueled over drip trays with absorbent spill pads.

- Vehicle oil should not be changed except over a drip tray.
- Any accidental releases of fuel should be cleaned up to the greatest extent possible and documented, including coordinates, in activity reports.

Lakes:

- Explosives should not be used on a lake.

- Vehicles should be used on lake ice only when essential; they should be parked on permanent ice rather than moat ice during the period of summer melt.

- Where possible, ensure that nothing is left frozen into the lake ice that may ablate out and cause later contamination.

- Avoid swimming or diving in the lakes, except when approved by a national program for scientific purposes.

Streams:

- Stream crossings should be avoided; when it is necessary to cross streams, designated crossing points should be used whenever possible.

- Avoid walking in the streambed at any time to avoid disturbing the stream biota.

- Avoid walking close to stream sides, to prevent erosion.

Valley floor and sides:

- Avoid disturbing mummified seals or penguins.

- Avoid sliding down screes or sand dunes.

- Avoid disturbing (e.g. by walking through) long-term soil experiments.

- Avoid disturbing the raised delta surfaces, which mark ancient shorelines.

High Desert:

- Beware not to damage delicate rock formations.

APPENDIX B:

Additional Guidelines for Conduct of Scientific Research

Research activities in the McMurdo Dry Valleys include research on climate, glaciers, streams, lakes, soils, and local geology and geomorphology. The following prevention and mitigation guidelines for scientific conduct seek to reduce the impact of research activities specific to key environments in the Area. These guidelines have been drawn from the report McMurdo Dry Valley Lakes: Impacts of Research Activities *(Wharton, R.A. and Doran, P.T., 1998), the product of an international workshop of scientists conducting research in the Area.*

Sampling and experimental sites

- All sampling equipment should be clean before being brought into the Area.
- The location of sampling sites should be recorded in the group's field report.
- Do not displace or collect specimens of any kind, including fossils, except for scientific and associated educational purposes.
- Once a sampling hole has been drilled in lake ice or a soil pit has been dug, it should be kept clean and all sampling equipment should be securely tethered.
- Avoid leaving markers (e.g. flags) and other equipment for more than one season without marking them clearly with the event number and duration of the project.

Scientific installations

For scientific installations, including meteorological stations, geographic monuments, communication repeaters, lake monitoring systems, and level recorders:

- Installations should be sited carefully, should be easily retrievable when required, and properly secured at all times to avoid dispersal by high winds.
- All installations in the Area should be clearly identified by country, name of the principal investigator and year of installation.
- Installations should be as energy-efficient as possible and use renewable energy sources wherever practicable.
- Installations should pose minimal risk of harmful emissions to the environment (e.g. use gel cells or other non-spill batteries).
- Geographic locations of installations should be recorded.
- Materials liable to shatter at low temperatures, for example many polyethylene based plastics, should be avoided. Likewise, wooden and fabric components in semi-permanent structures should be avoided as these are subject to wind abrasion and occasional failure.

Streams

- Use flumes rather than weirs.
- Use local sand or soil in sandbags when constructing flumes or control structures.
- Document the geographic location of all stream control structures, biological transects, and instrumentation.
- Periodically (every 3-5 years) evaluate in-stream structures (e.g., flumes) for deterioration, usefulness, and potential removal.
- Limit the number of tracer and manipulative experiments. Whenever possible, use modeling approaches to extend the application of experimental results to other streams and lake basins.
- Use only naturally occurring tracers and document tracer use.
- Design tracer experiments to limit the movement of tracers in lakes. The incremental flux from the experiment should be appropriately small in proportion to the average annual total flux for that solute from streams. Choose an experimental site with a long enough reach such that reactions will be completed by the end of the reach.
- Establish specific sites for biomass sampling and document geographic locations, sampling extent, and frequency.
- Limit biomass sample size to that required for the planned analyses and archiving.
- Develop and apply methods (e.g., spectral analysis) that do not rely on removal of samples for quantifying changes in biomass in streams.

Lakes

- Minimize the duration and extent to which structures are placed on the ice. When placing structures on the ice near shore, place them on the perennial ice rather than the moat (the moat is highly susceptible to rapid melting). Document the geographic location of the placement of structures on the ice.
- Minimize the use of fossil-fuel-powered equipment; use solar-powered and hand devices when possible. Use barriers (e.g., drip pans) between equipment (e.g. motors, tools) and ice to minimize the potential for hydrocarbon introduction into the ice as well as the physical melting of the ice surface. Always have appropriate spill kits available.
- Document the area and the extent to which lake ice has been excavated, taking geographic coordinates. Areas that have been used for sampling or accessing the lake should be reused to the greatest extent possible.
- Minimize the use of motorized vehicles. All-terrain vehicles with four-stroke engines are preferable to snowmobiles with two-stroke engines (less efficient combustion in two-stroke engines causes an increase in the release of hydrocarbons and particulates).

- Use extreme caution when driving motorized vehicles to avoid rolling the vehicle or breaking through the ice cover.

- Remove materials brought up from beneath the ice. Do not dump or deposit water and sediment samples on the lake ice.

- Reduce helicopter overflights after the ice surfaces begin to melt and keep landings on lakes to a minimum.

- Avoid storage of materials on the lake ice surface.

- Use separate samplers (e.g., water collectors, plankton nets) and instruments, if feasible, for each lake to avoid cross contamination. Samplers or instruments used in more than one lake should be thoroughly cleaned (sterilize if possible) prior to reuse in a different lake.

- Carefully manage chemical waste, glycol, and all other liquid wastes (including gray water from the lakes themselves) to avoid spills.

- Consider laboratory-based alternatives to *in situ* experiments involving any radioisotope, stable isotope, or other tracer in view of the future integrity of the biological and chemical properties of the lakes. Complete preliminary calculations to ascertain the potential impact of isotope experiments. Document and record any introductions.

- Incorporate metal-free haul lines and sampling containers such as "go-flow" bottles into sampling protocols to minimize metal contamination of the lakes.

- Promote use of an environmentally friendly substitute for glycol for use in melting access holes (e.g., a biodegradable antifreeze).

- Minimize the amount of gray water waste by collecting the least volume of water and sediment needed for research purposes.

- Train individuals working on the lake ice to take steps to reduce the loss of equipment through ice holes.

- Provide adequate training for research divers and support teams so that impacts to the lake environment are minimized.

- Prior to conducting diving or ROV operations in a particular lake, consider previous diving history at the proposed research site, the proximity of other areas of interest, and the vulnerability of the water column and benthos to disturbance. These considerations should also be applied to other sampling and measuring activities.
- Assemble and maintain records of diving and ROV activities, including timing, intensity, and duration.

- Use technological developments (e.g. rebreather apparatus, push-pull systems) that mitigate the environmental impacts of diving.

Soils

- Restore disturbed surfaces as close as possible to their natural state upon completion of the work. For larger-scale excavations (greater than 1 m^2), take photographs prior to breaking ground to provide a basis for restoration. Record the location of the remediated site.

- Place excavated soil on mats or groundsheets during soil sampling.

- Backfill all excavations to approximate original contour and replace desert pavement where possible. The desert pavement can be skimmed from the surface prior to digging and kept aside for replacement.

- Document the geographic location of all soil sampling sites (even if they have been back-filled).

- Conduct thorough environmental assessment of proposed exogenous amendment experiments.

- Limit use of mechanical equipment (e.g., Cobra drills, soil augers).

Glaciers

- Minimize the use of liquid water (e.g., with hot water drills).

- Avoid the use of chemicals and chemical solutions on the ice.

- If stakes or other markers are placed on a glacier, use the minimum number of stakes required to meet the needs of the research; where possible, label these with event number and project duration.

- Provide spill kits on-site where power tools are being used. Always refuel using drip pans.

- Properly tune generators to minimize emissions and use only when necessary. Always place generators and fuel cans in drip pans.

- Use electric chainsaws powered by a four-stroke generator whenever possible for large-scale sawing operations (less contamination than from two-stoke engines). Avoid the use of chainsaw blade lubricants when cutting cold ice.

- Upon completion of a research project, remove all materials – wood, metal, and sensors – embedded in the ice to minimize contamination.

- Use gel cell or other non-spill batteries.

High Desert:

- Only the minimum sample of endolithic community required for scientific analysis should be collected.

APPENDIX C:

Guidelines for Facilities Zones

Facilities Zones include a designated area around the following facilities operated by national programs in the Area: Lake Vanda Huts, Lower Wright Camp, Bull Pass Hut, Cape Roberts Camp, New Harbor Camp, F-6 Camp, Lake Fryxell Camp, Lake Hoare Camp, Lake Bonney Camp, Marble Point Refueling Station, Odell Glacier Camp and Odell Landing Site, and the radio repeater stations at Mt. Newall. Special guidelines for activities in the Facilities Zones include that:

- Facilities, camping, helicopter pads, and storage of materials should be located within the boundaries of the Facilities Zones;

- Existing camping and storage sites within the Facilities Zones should be re-used where practicable;

- Provisions for fuel storage and handling within the sites should take account of the requirements set out in the McMurdo Dry Valleys ASMA Management Plan by providing secondary containment, appropriate equipment for refilling, decanting or servicing operations, secure storage and appropriate spill response materials; and

- All wastes should be securely stored until removal.

Table 3 gives boundary descriptions for the Facilities Zones.

Table 3: Boundaries for each of the Facilities Zones within the Area.

Facility Zone	Boundary Description	Boundary Corners
Bull Pass Huts	The boundary encompasses the pebbly flat on which the huts and tent sites are situated, and is bounded by a large boulder to the north, small rocky ridges to the east and west, and a line between ridge ends to the south. An AWS is established well to the west of the zone boundary.	77.5181°S, 161.8539°E; 77.5179°S, 161.8493°E; 77.5164°S, 161.8519°E; 77.5167°S, 161.8559°E;
Cape Roberts Huts	The boundary encompasses all of the flat area between North and South beaches on Cape Roberts, including the two huts and fuel rack. The south-east corner of the Zone is at the fuel rack, and the boundary continues north along the edge of a bouldery slope, west along the edge of a rocky area, and south behind the huts along the edge another rocky slope. The Zone is bounded to the south by the shoreline of a small bay.	77.0346°S, 163.1789°E; 77.0346°S, 163.1799°E; 77.0348°S, 163.1807°E; 77.0360°S, 163.1798°E;
F-6 Camp	The boundary goes from a point southwest of the helicopter pad, northeast to a point just east of the emergency cache (survival box), north around the northern-easternmost tent site, west to a point northwest of the tent sites (by the lake), south	77.6088°S, 163.2554°E; 77.6084°S, 163.2571°E; 77.6076°S,

	around the stream weir, and southeast to the original point by the helicopter pad.	163.2577°E; 77.6076°S, 163.2566°E; 77.6077°S, 163.2535°E; 77.6083°S, 163.2532°E.
Lake Bonney Camp	The boundary goes from a point west of the generator shed by the lake, southeast up to a boulder behind a tent site, northeast to a hill above a tent site, northeast, north to a point northeast of the easternmost tent site, west to the shoreline, southwest along the shoreline passing north of the helicopter landing pad, continuing southwest along the lake shore to a point northwest of the meteorological station and back to the original point below the generator shed.	77.7160°S, 162.4562°E; 77.7165°S, 162.4593°E; 77.7162°S, 162.4632°E; 77.7158°S, 162.4655°E; 77.7150°S, 162.4621°E; 77.7153°S, 162.4602°E;
Lake Fryxell Camp	The boundary follows the lake edge in the southeast corner to a point southwest of the helicopter pad, up to the small plateau below hill, behind the farthest tent site in the northwest corner, east to the stream, southeast along the stream bank to the eastern most tent and south back to original point by the lake.	77.6063°S, 163.1267°E; 77.6066°S, 163.1229°E; 77.6057°S, 163.1218°E; 77.6056°S, 163.121°E; 77.6049°S, 163.1212°E; 77.6048°S, 163.1252°E; 77.6052°S, 163.1265°E; 77.6063°S, 163.1266°E.
Lake Hoare Camp	The boundary goes from the rocky area southeast of the helicopter pads, north around the emergency cache, northeast to a rock northwest of the westernmost tent site, northeast to a point north of another tent site, northeast again to the northeastern most tent site, south along the stream/glacier to a point east of the Old Lake Hoare facilities (shower and dive storage buildings), southwest to the end of the spit, northwest to the beach below the main building, and northwest to the original point by the helicopter pads.	77.6233°S, 162.8978°E; 77.6231°S, 162.8977°E; 77.6225°S, 162.8979°E; 77.6219°S, 162.8993°E; 77.6210°S, 162.9047°E; 77.6210°S, 162.9058°E; 77.6232°S, 162.9066°E; 77.6245°S, 162.9056°E; 77.6235°S,

		162.9008°E.
Lake Vanda Huts	The boundary follows the edge of the flat area on which the huts, AWS, marked helicopter landing site and tent sites are located.	77.5236°S, 161.6859°E; 77.5234°S, 161.6861°E; 77.5223°S, 161.6909°E; 77.5224°S, 161.6919°E; 77.5226°S, 161.6919°E; 77.5235°S, 161.6875°E;
Lower Wright Camp	The boundary encompasses the hut, a marked helicopter landing site, and an emergency box and is bounded by rising slopes on the western and eastern sides, a large pavement crack at the southern end and rocky areas at the northern end. A met screen and weir are outside the zone within walking distance of the site.	77.4426°S, 162.6507°E; 77.4422°S, 162.6503°E; 77.4421°S, 162.6522°E; 77.4425°S, 162.6525°E;
Marble Point Refueling Station	The boundary goes from the easternmost point (east of soil pits), northwest around the main facilities area, northwest around the fuel storage tanks and pipe, northwest along the road, southwest around the end of the road and staging area, southeast along the road and around the helicopter pads, southeast around the pond, and northeast back to the point east of the soil pits.	77.4143°S, 163.6901°E; 77.4136°S, 163.687°E; 77.4135°S, 163.6837°E; 77.4134°S, 163.6801°E; 77.4119°S, 163.6708°E; 77.4123°S, 163.6692°E; 77.4143°S 163.679°E 77.4148°S 163.6878°E.
Mt. Newall Radio Repeater Site	The boundary goes from the northeastern most point northeast of the green equipment shelter, southwest along the southeastern side of the ridge around the green equipment shelter, the NZ Repeater, the wind turbine, the AFTEC Hut, the antenna, the survival camp hut, the survival cache, around the helicopter landing pad, northeast along the northwestern side of the ridge around the camp hut, the antenna, the AFTEC Hut, the wind turbine, the NZ Repeater, and the green equipment shelter back to the original point.	77.5039°S, 162.6267°E; 77.5041°S, 162.6266°E; 77.5043°S, 162.6258°E; 77.5045°S, 162.6253°E; 77.5045°S, 162.6253°E; 77.5048°S, 162.6244°E; 77.5052°S, 162.6222°E; 77.5049°S,

		162.6213°E; 77.5047°S, 162.6233°E; 77.5043°S, 162.6249°E, 77.5039°S, 162.626°E.
New Harbor Camp	The boundary goes from a point northwest of the generator shed (on the bank edge), southwest beyond the slingload area, east to a point south of the helicopter pad, northeast to a point east of the main Jamesways, northwest to a point north of the lab building, southwest to a point just north of the old bore hole, and southwest along the bank edge back to the point by the generator shed.	77.5777°S, 163.5175°E; 77.5785°S, 163.5163°E; 77.5783°S, 163.5199°E; 77.5778°S, 163.5223°E, 77.5772°S, 163.5198°E; 77.5773°S, 163.5185°E.
Odell Glacier Camp and Landing Site	This Facility Zone encompasses two distinct components: the Odell Glacier Camp and the Odell Landing Site. The boundary of the Camp is defined by a circle with a 35 m radius from the center of Camp, encompassing the hut, generator, wind generator, solar array, a Scott tent, and the helicopter landing site. The camp lies in a hollow formed by the sloping ice of the glacier and an indentation in the Allan Hills (at a junction of blue ice and a snow slope on the flank of the Allan Hills). The Boundary of the Odell Landing Site is defined by the North Lobe of the Odell Glacier.	Odell Glacier Camp: a circle with 35m radius around center of camp at 76.6810°E, 159.9134°S. Odell Landing Site: Between 76.6472°S, 159.9690°E (threshold) and 76.6629°S, 159.9553°E (departure end), 1790 m. (5870 ft) long, and 104 m (340 ft.) in width.

Table 4 shows the number of helicopter landing sites that exist at each of the Facilities Zones.

Table 4: Helicopter landing sites within each of the Facilities Zones in the Area

Facilities Zone	**Number of Designated Helicopter Landing Sites**
Bull Pass Hut	1 pad
Cape Roberts Camp	0 pads
F-6 Camp	1 pad
Lake Bonney Camp	1 pad
Lake Fryxell Camp	2 pads plus sling load area
Lake Hoare Camp	2 pads plus sling load area
Lake Vanda Huts	1 pad

Lower Wright Hut	1 pad
Marble Point Refueling Station	3 pads
Mt. Coates Radio Repeater Site	0 pads
Mt. Newall Radio Repeater Site	1 pad
New Harbor Camp	1 pad plus sling load area
Odell Glacier Camp and Odell Landing Site	1 pads

APPENDIX D:

Guidelines for the Tourism Zone

Special guidelines for activities within the Tourism Zone include that:

- Tourist movements in the Tourism Zone should be conducted in small, guided groups;
- Tour operators should ensure that footpaths in the Tourism Zone are clearly marked and that visitors stay on those routes. Markers used to mark tourist routes and sites of interest should be removed at the end of each visit;
- Tour expedition landings should be made at a landing site at 77.6358°S, 163.0656°E;
- Tents should only be established at the designated site and groups should not camp in the Tourism Zone except for reasons of safety;
- Stream and pond beds should be avoided. If streams must be crossed, designated crossing points including existing boulders should be used; and
- Activities planned for and conducted within the Zone should be in accordance with ATCM Recommendation XVIII-1.

The Tourism Zone is located in the Taylor Valley by the Canada Glacier. The boundary goes from a northernmost point by the Canada Glacier, southeast to a point northwest of a mossy area and nearby mummified seal, continuing southwest along the Canada Glacier, south to a point southwest of a bamboo marker, southeast to a point south of a rock cairn, southeast following high points encompassing the flat area of the Zone and a footpath to a point in the south, north continuing to parallel the footpath along elevated features in the landscape, northwest passing northeast of a mummified seal and the tent site and back to the original northernmost point by the Canada Glacier.

APPENDIX E:

Guidelines for Special Features

The following guidelines apply to the Special Features listed in this Appendix.

- Minimize sampling and research activities at or around Special Features.
- All sampling at the Special Features, including type and quantity, should be recorded in group field reports and provided to the appropriate national program.
- Helicopters should land at least 50m away from each Special Feature.

Special Features, including a geographic location, description, and special guidelines:

1. *Prospect Mesa* (77.5237°S, 161.8896°E)
   Prospect Mesa contains unique marine deposits.
   - Avoid walking on top of the mesa unless conducting research activities.

2. *Argo Gully* (77.5197°S, 161.6901°E)
   This stream section across from Vanda Station is a unique middle-Miocene marine deposit.
   - Avoid walking along the surface edge above the Gully.

3. *Boulder Pavement* (77.5227°S, 161.7466°E)
   Boulder Pavement is on the Onyx River and contains the most extensive area of microbial mat in the Wright Valley and serves as a biofilter for Lake Vanda.
   - Avoid crossing the Boulder Pavement unless necessary for sampling purposes.
   - While sampling, walk only on the rocks and avoid trampling the microbial mats.

4. *Battleship Promontory* (76.8996°S, 161.0055°E)
   A sandstone promontory containing rich cryptoendolithic communities.
   - Avoid damage to these ancient communities and rocks.

5. *Don Juan Pond* (77.5630°S, 161.1896°E)
   A hypersaline ecosystem containing unique salt deposits.
   - Avoid walking through the lake and adjacent salt deposits.
   - Do not disturb salt deposits to avoid further deterioration.

6. *Trough Lake Catchment* (78.2736°S, 163.4652°E)
   A pristine example of a complete hydrological unit (streams, ponds, lakes).
   - Minimize visits to this catchment that has not been highly visited and is therefore useful as a reference site with its relatively pristine landscape.

7. *Sand Dune Field* (77.3715°S, 162.2205°E), (in Lower Victoria Valley)
   The largest sand dune feature in the Area.
   - Avoid walking on the dunes.

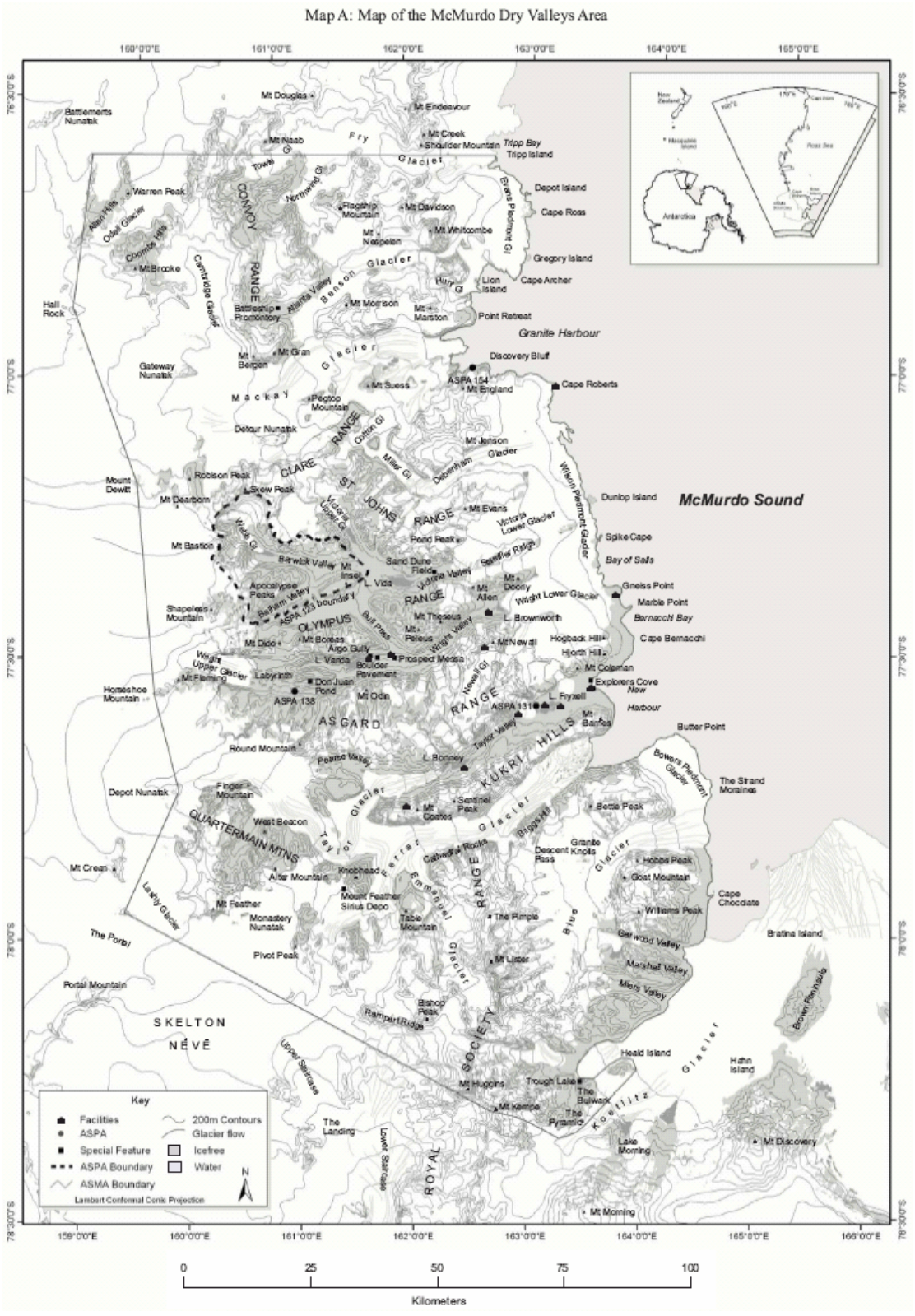
8. *Explorers Cove* (77.5770°S, 163.5169°E)

A tidally inundated sand flat characterized by tide pools containing unique benthic mats of diatoms and cynobacteria.

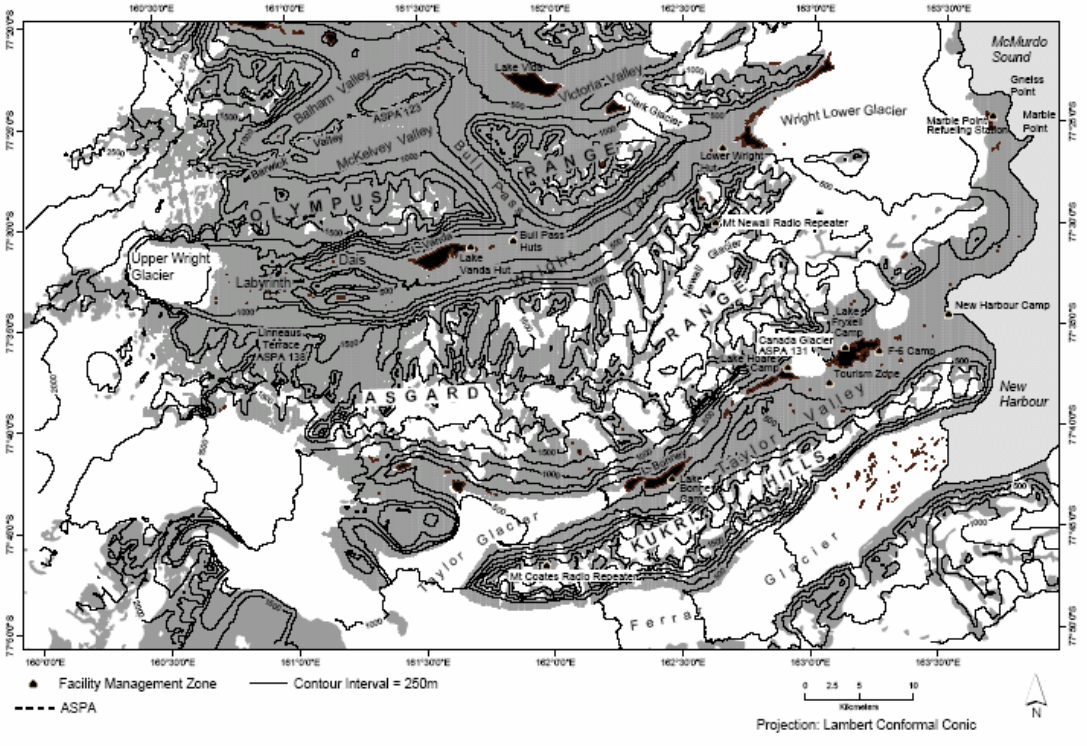
- Avoid walking in areas of scientific sampling and in tide pools after they thaw in mid-November.

9. *Mount Feather Sirius Deposit* (77.9320°S, 161.4367°E)
   An important location of Sirius deposits.

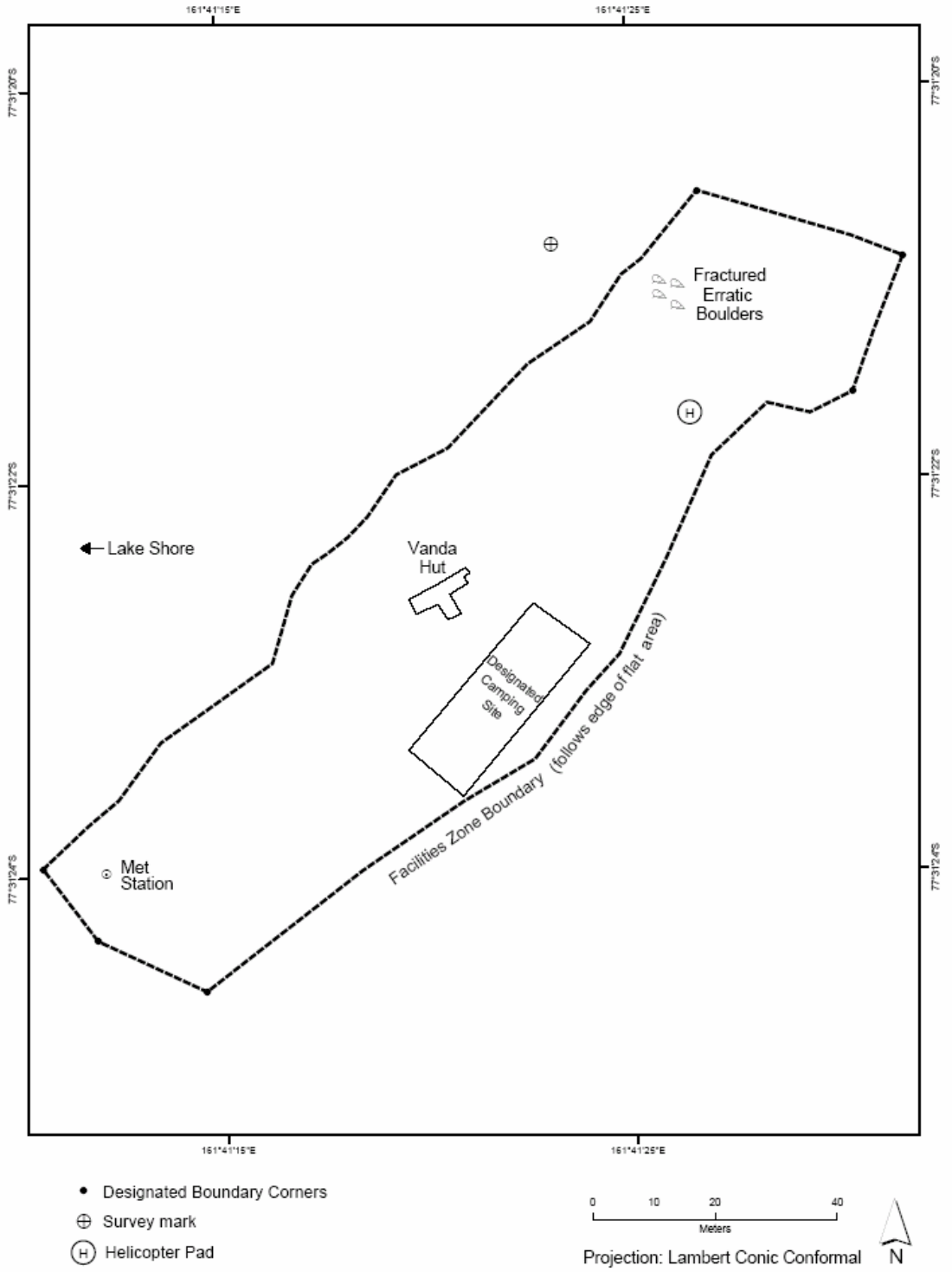
Map A: Map of the McMurdo Dry Valleys Area



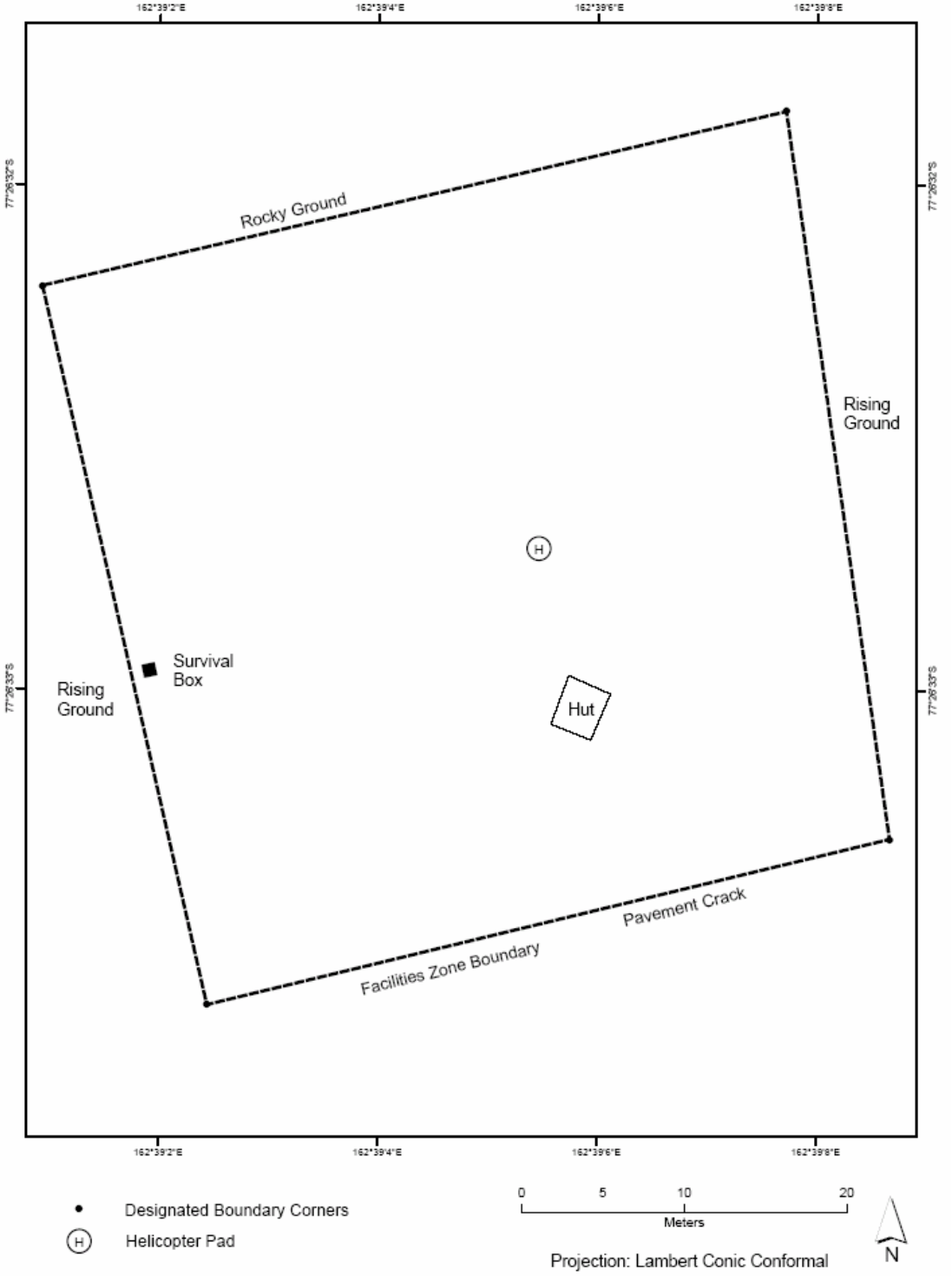
Map B: Wright Valley and Taylor Valley



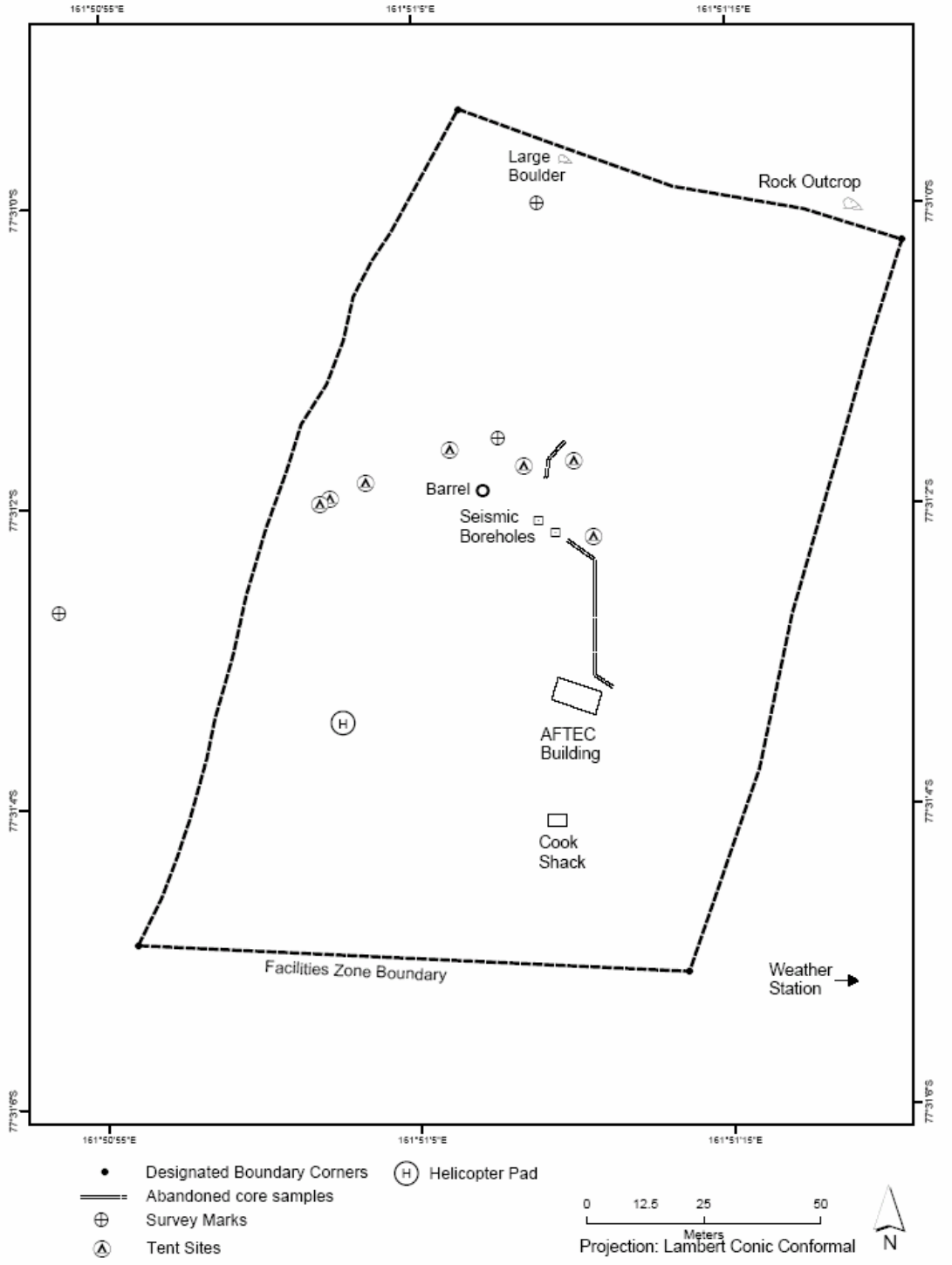
Map C: Lake Vanda Hut Facilities Zone



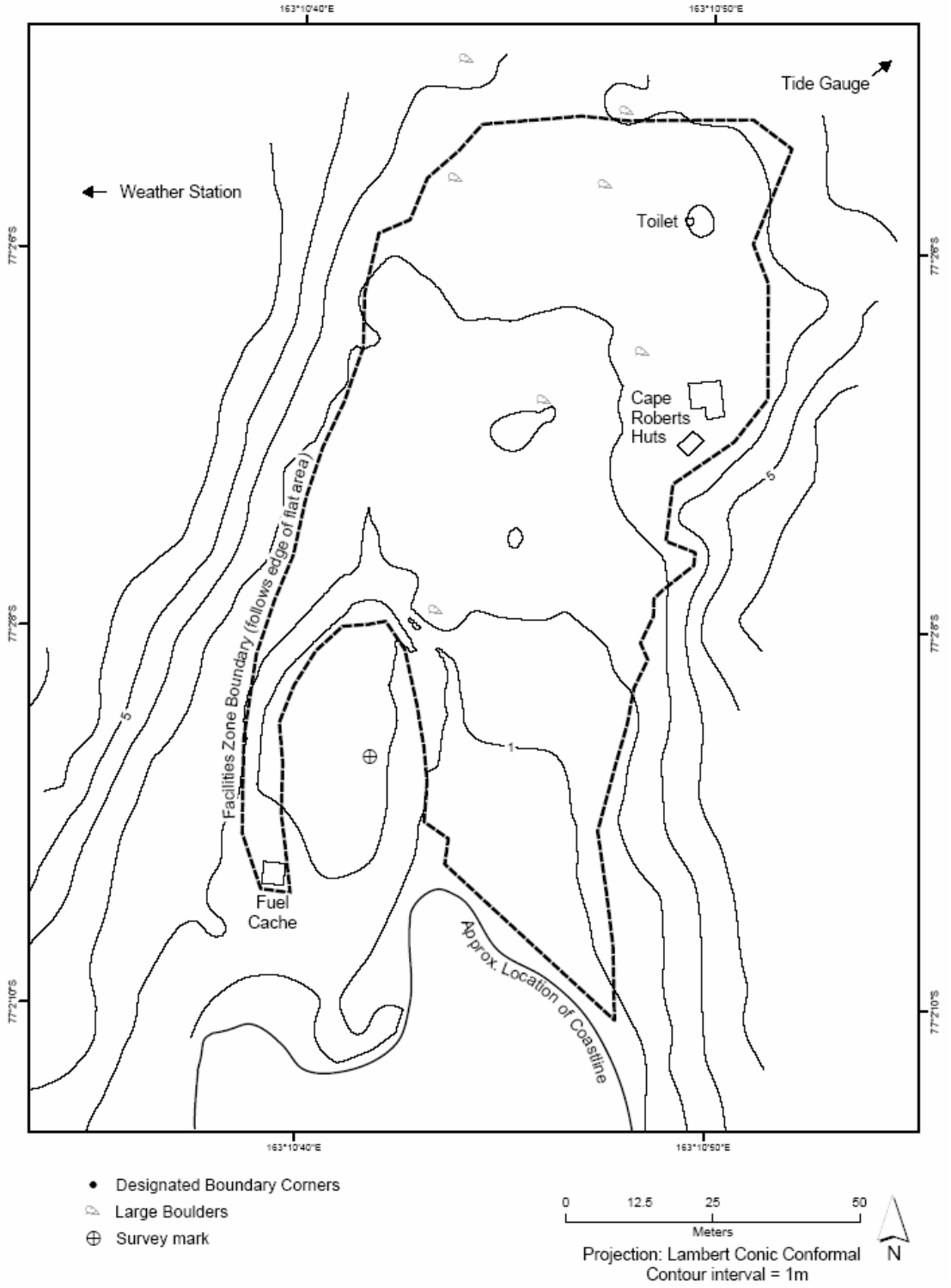
Map D: Lower Wright Hut Facilities Zone



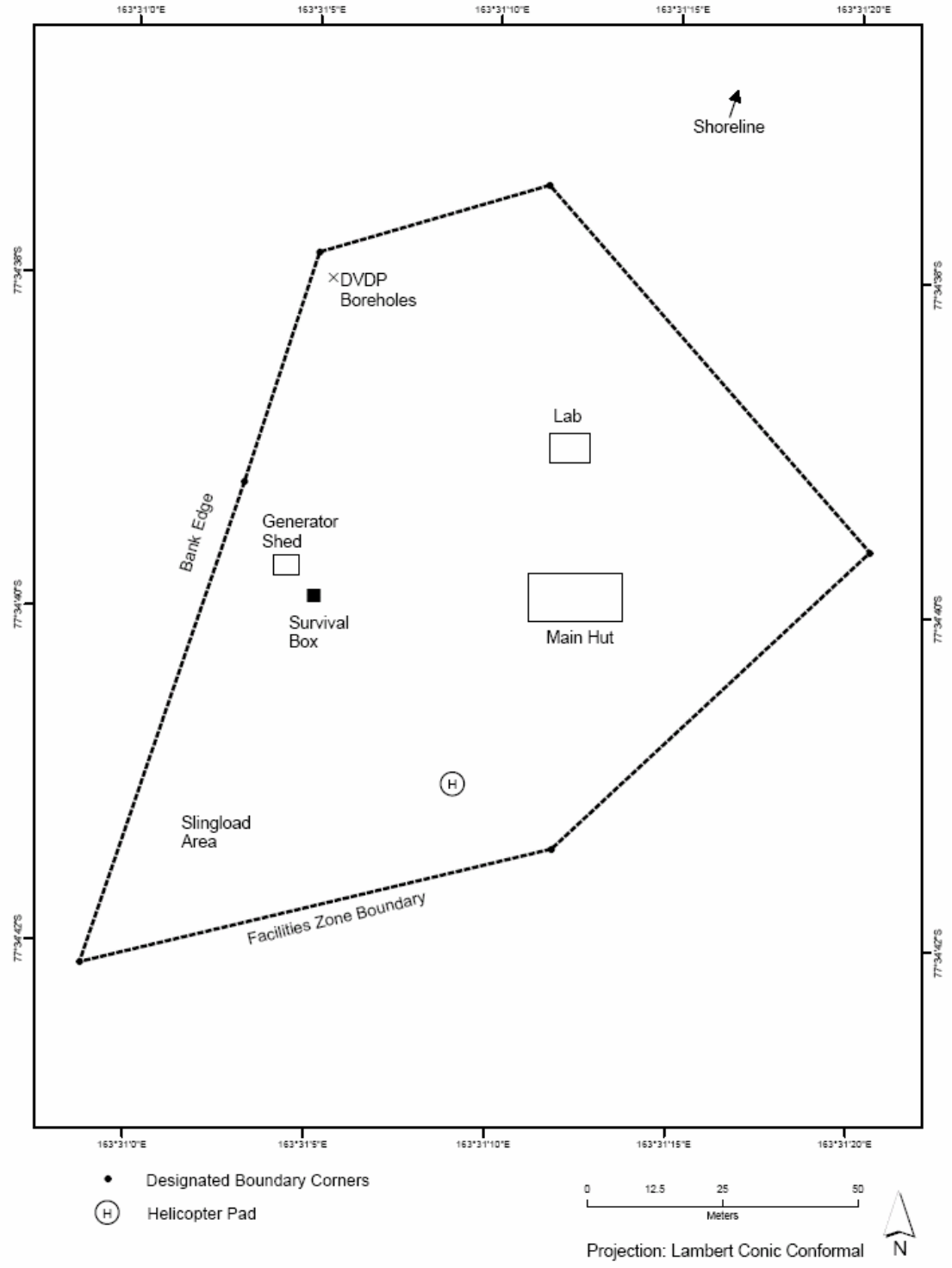
Map E: Bull Pass Hut Facilities Zone



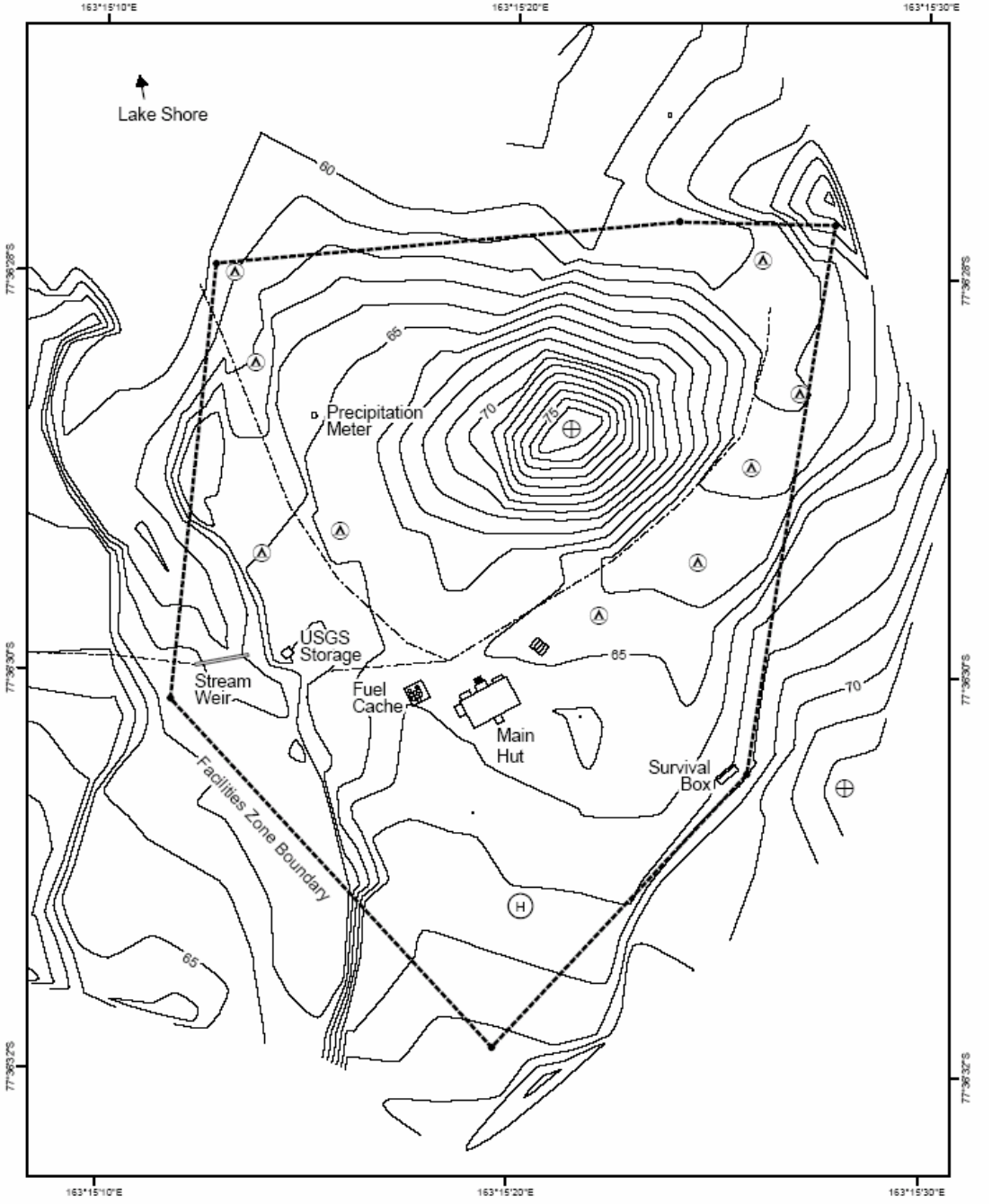
Map F: Cape Roberts Camp Facilities Zone



Map G: New Harbor Camp Facilities Zone



Map H: F-6 Camp Facilities Zone



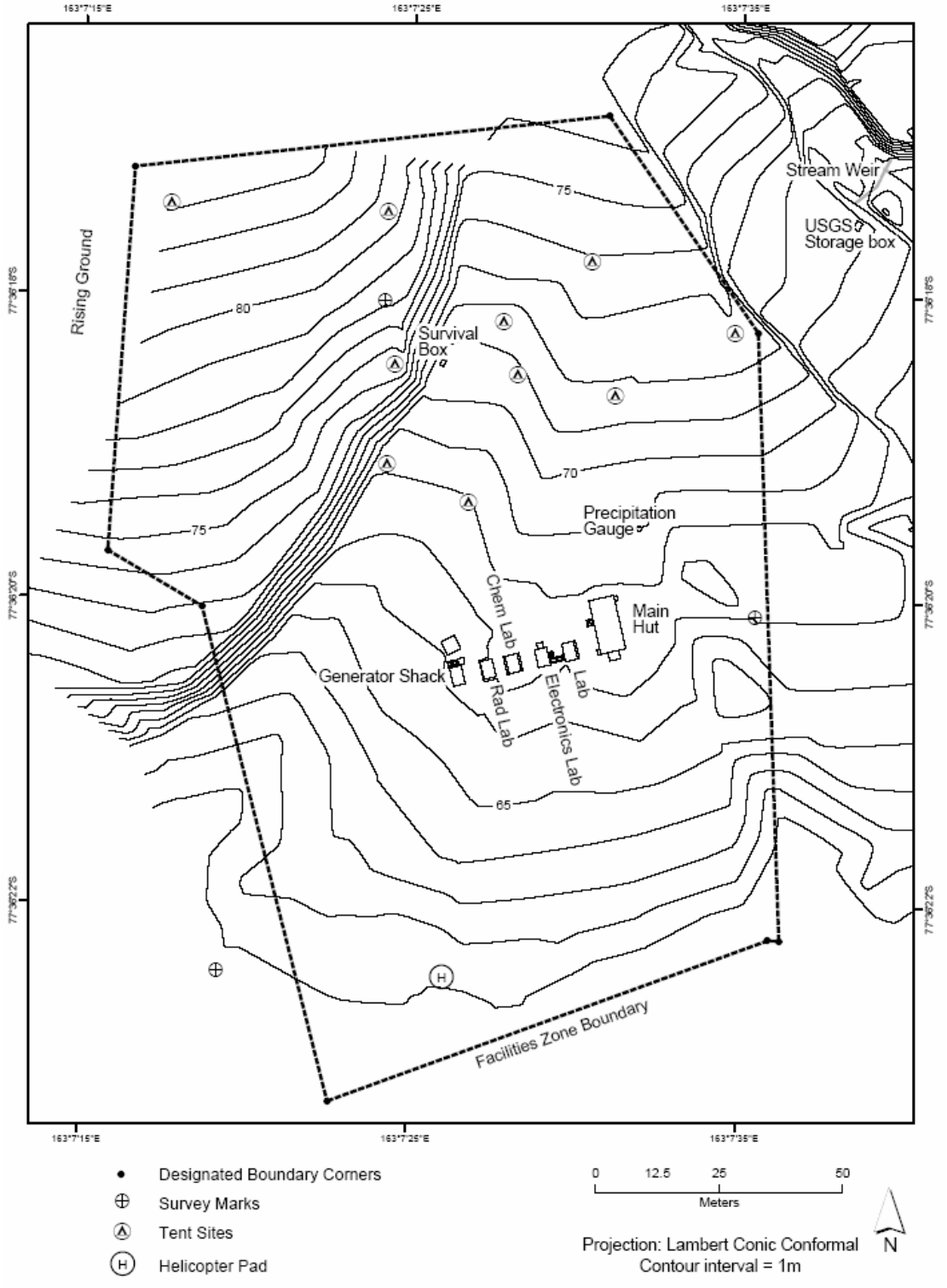
- Designated Boundary Corners
- Survey Marks
- Tent Sites
- Helicopter Pad

0 12.5 25 50
Meters

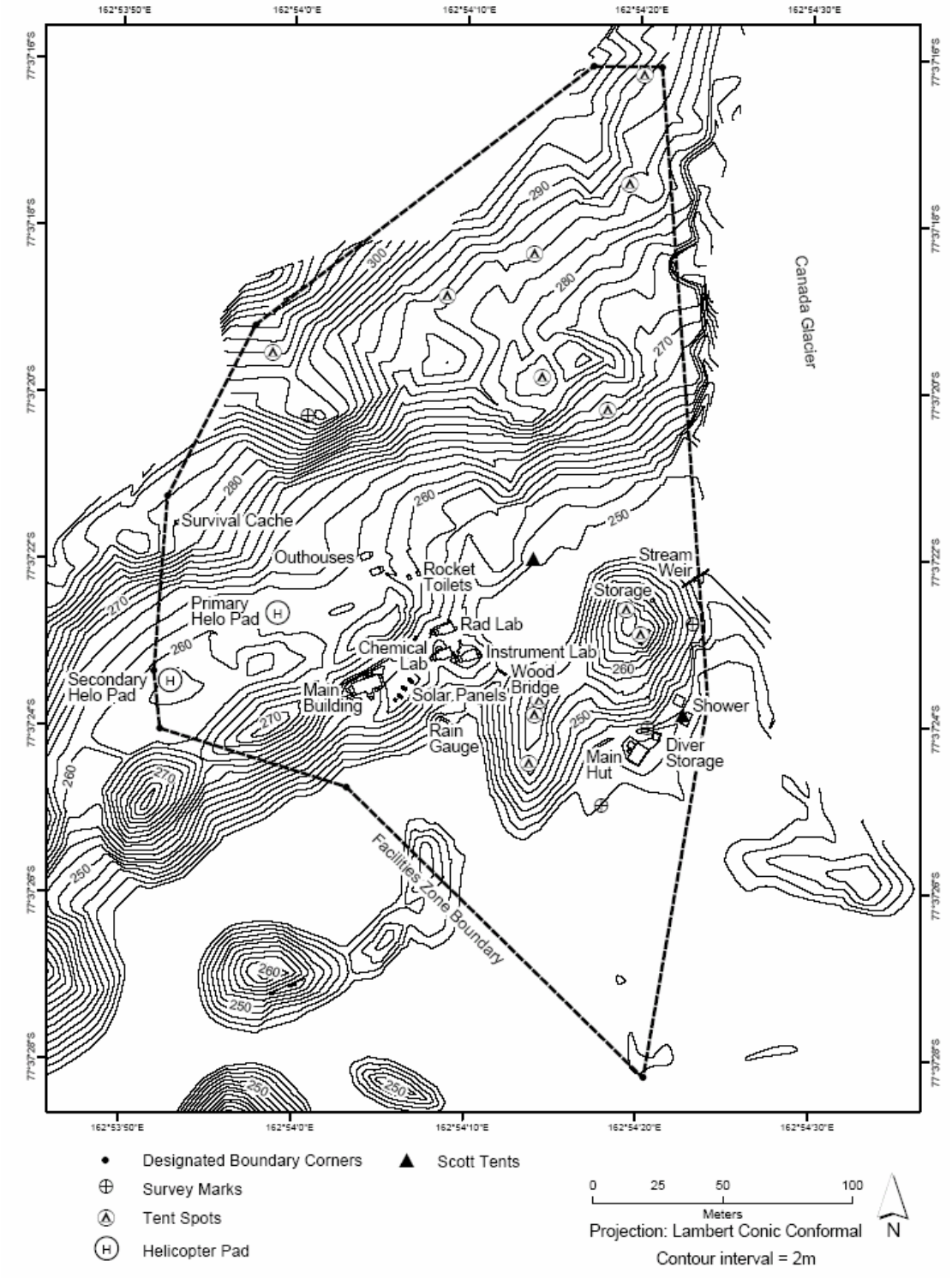
N

Projection: Lambert Conic Conformal
Contour interval = 1m

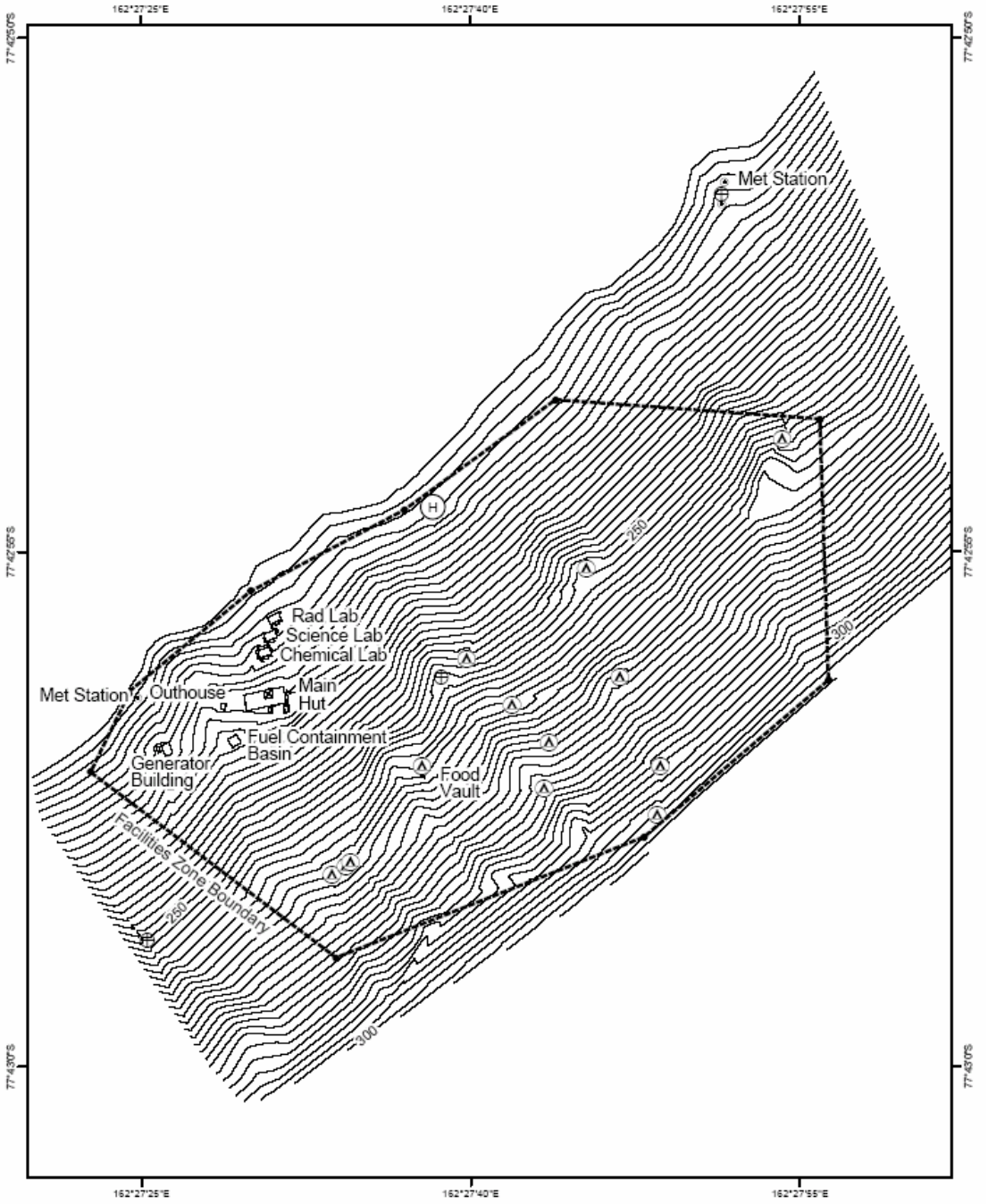
Map I: Lake Fryxell Camp Facilities Zone



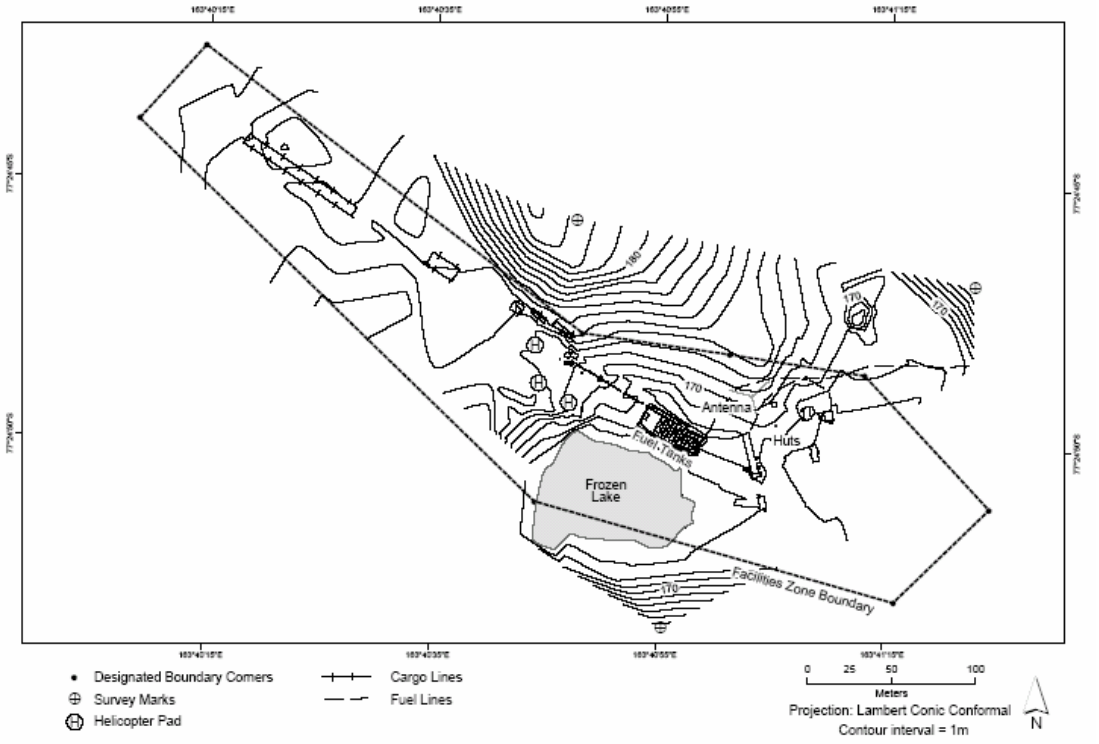
Map J: Lake Hoare Camp Facilities Zone



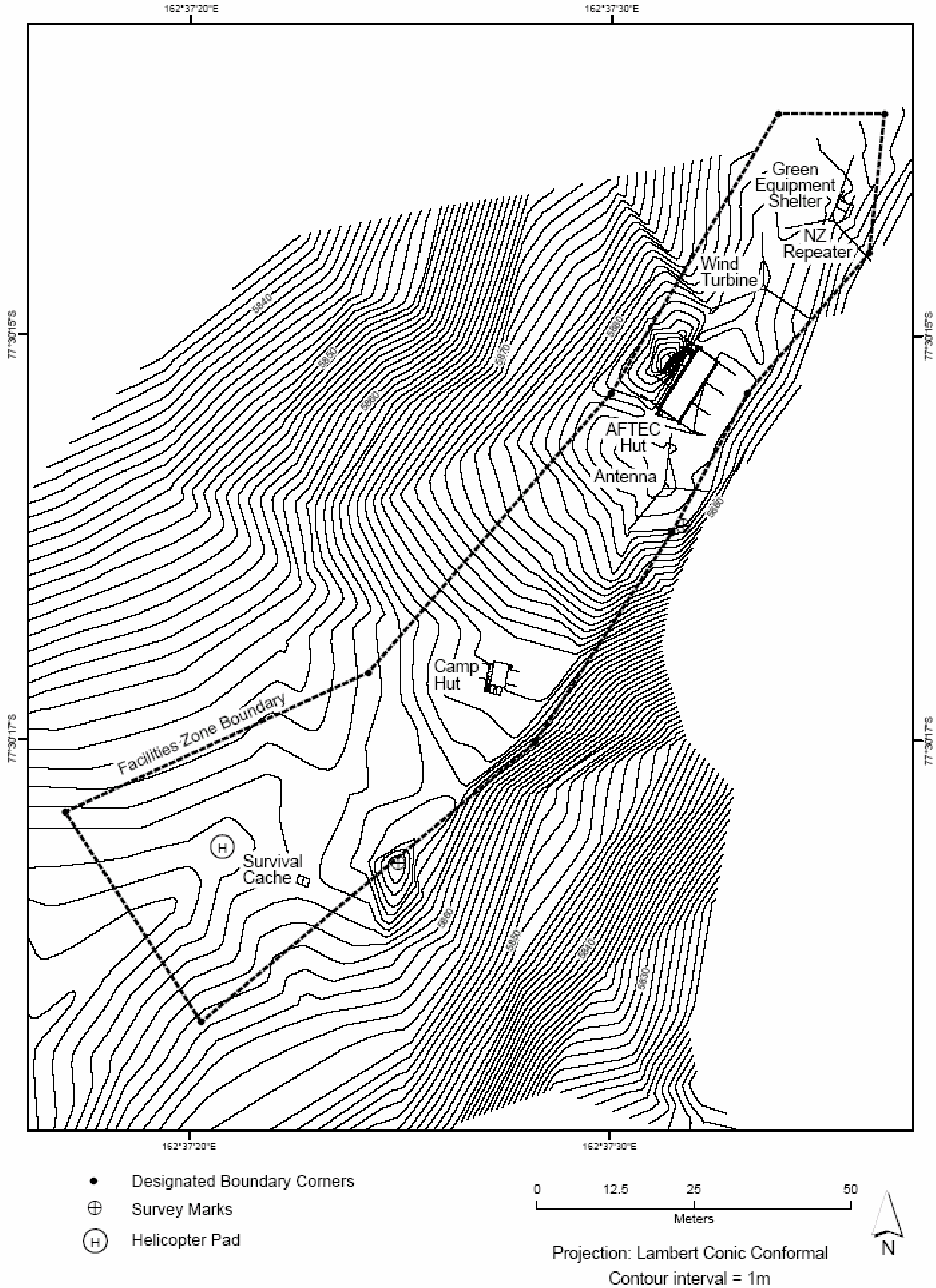
Map K: Lake Bonney Camp Facilities Zone



Map L: Marble Point Refueling Station Facilities Zone



Map M: Mt. Newall Facilities Zone



Map N: Canada Glacier Tourism Zone