WEST COAST CONSERVANCY

Karamea Estuary (45)

Location: 41°16'S, 172°06'E. 1 km southwest of Karamea, South Island.
Area: c.666 ha.
Altitude: Sea level.
Overview: A moderately large, shallow estuary exhibiting a transition from sea to freshwater and land, with inter-tidal mudflats, saltmarshes and swamps protected from the sea by a low barrier beach and dune system. The estuary is surrounded by considerable areas of farmland, but is particularly important for its high avifaunal, ecological and archaeological values.
Physical features: A moderately large but shallow estuary, 5 km long and one km wide, with extensive mudflats, sandflats and saltmarshes. Resting on a low-lying prograded beach and alluvial surface beneath a 100 m marine terrace, it is divided into two distinct parts (north and south), with interchanges of water only at times of flood and high tides. The northern part of the estuary is fed primarily by the Karamea River, and the larger southern part is fed primarily by Granite Creek and Kongahu Swamp. The estuary is bounded to the west by the Tasman Sea, and to the east by the Karamea plains. Historical changes, such as land development and coastal erosion, have significantly altered the hydrology of the estuary.
Ecological features: Karamea Estuary is a valuable example of an estuarine system with tidal mudflat and saltmarsh communities. The mudflats are rich in weed (*e.g.* eelgrass *Zostera novazelandica*) and benthic invertebrates (*e.g. Amphibola crenata* and *Austrovenus stutchburyi*). The marginal saltmarsh and swamp vegetation includes *Samolus repens*, *Leptocarpus similis*, *Juncus* spp. and *Phormium tenax*. The barrier beach dunes are dominated by Marram Grass *Ammophila arenaria*, while the inland margins and surrounding areas are mostly pasture grass flats.
Land tenure: The bed of the estuary below mean high water mark and the southern spit bordering it are Crown land managed by the Department of Conservation. The rest of the margins of the estuary (including some saltmarsh areas) are private land. Most of the surrounding land is privately owned.
Conservation measures taken: A small area of freshwater flax swamp that feeds into the estuary near Granite Creek is a whitebait sanctuary where whitebaiting is prohibited. Whitebait spawning areas have been identified in the estuary.
Conservation measures proposed: None known.
Land use: Considerable areas of the margins of the estuary have been developed for livestock grazing (mostly cattle). The estuary itself is also browsed by cattle, and is used for whitebaiting. Much of the surrounding area is developed farmland, supporting a dairy industry that is important to the local economy.
Possible changes in land use: None known.
Disturbances and threats: Marginal areas of the estuary have been developed for stock grazing and other uses, and this puts considerable pressure on the values of the wetland. Parts of the estuary, particularly on the southern spit, are not adequately fenced to exclude cattle, and livestock sometimes damage the wetland by trampling and browsing of saltmarsh vegetation. Exotic plants such as pasture grasses, gorse and marram encroach into the margins of the estuary. Continuing drainage and clearance of adjacent farmland alters the hydrology of the estuary, and reduces the buffering effects and other values of the marginal vegetation.
Hydrological and biophysical values: Karamea Estuary is an important biophysical transition from sea to freshwater and land for many species and biological communities. The estuary plays a significant role in sediment trapping, and is of great importance in supporting aquatic

and terrestrial food chains. Of particular note is the role of the estuary as a whitebait spawning area.

Social and cultural values: The estuary is important as a recreational fishing area. The area had already been abandoned by the Maori when Heaphy and Brunner travelled through in 1846. They reported extensive areas of reverting scrub and fernlands. Archaeological sites comprise old campsites and an extensive shell midden on the edge of the estuary. Within the estuary, there are the remains of several river training walls constructed in the early twentieth century.

Noteworthy fauna: The estuary supports a high diversity of waterbirds. About 40 species of birds have been recorded in the area, including a number of migratory shorebirds. The estuary supports large numbers of Mallard *Anas platyrhynchos*, Grey Duck *A. superciliosa*, South Island Pied Oystercatcher *Haematopus finschi* and Banded Dotterel *Charadrius bicinctus*. It is one of the few areas in North Westland with a population of Black Swan *Cygnus atratus*. The marginal saltmarsh and swamp vegetation supports Australasian Bittern *Botaurus poiciloptilus* and South Island Fernbird *Bowdleria punctata punctata*, and possibly also Banded Rail *Rallus philippensis assimilis* and crakes *Porzana* spp.

The estuary is important habitat for a number of fish species, many of which are diadromous, *e.g. Galaxias* spp. and *Anguilla* spp. Other species, such as flounder, are mostly resident in the estuary. The marginal pasture grass and saltmarsh vegetation provides important spawning areas for whitebait *Galaxias maculatus*.

Noteworthy flora: There is a lack of information on noteworthy plant species, but the overall quality and diversity of the estuarine plant communities at Karamea Estuary are of considerable importance. Marginal saltmarsh vegetation is a particularly vulnerable habitat type that is abundant at Karamea Estuary.

Scientific research and facilities: Very little scientific research has been carried out on the estuary, and no significant research facilities exist there.

Conservation education: The estuary is not widely used for conservation education, but may have some local potential in this field due to its proximity to Karamea township

Recreation and tourism: The estuary is locally important for recreational boating and fishing.

Management authority: The Department of Conservation (West Coast Conservancy) is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources and the preparation of coastal plans. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.

Jurisdiction: Territorial: West Coast Regional Council and Buller District Council. Functional jurisdiction for conservation: Department of Conservation.

References: Davis (1987); Department of Conservation (1986); Morse (1981); Neale (1990).

Reasons for inclusion:

1a Karamea Estuary is a particularly good example of a bar-built estuarine mudflat-saltmarsh wetland in the West Coast region. Such communities are nationally uncommon and vulnerable.

2a The estuary supports a population of *Botaurus poiciloptilus*, a globally threatened species.

2b The quality and diversity of the plant and animal communities contribute greatly to the maintenance of the region's ecological diversity.

2c The estuary is an important breeding, feeding and migration staging area for a large number of fish and bird species.

Source: Don Neale, Ray Hooker and John Lyall.

Lake Christabel (46)

Location: 42°25'S, 172°14'E. 8.5 km south-southeast of Springs Junction, Lewis Pass area, South Island. The lake is within the Victoria State Forest Park.
Area: c.270 ha.
Altitude: 645 m.
Overview: Lake Christabel is a deep, avalanche-dammed lake that is isolated from disturbances by a natural underground outlet and an unmodified forest/subalpine catchment. The lake is significant as being the largest lake in New Zealand from which exotic fish species are absent.
Physical features: The lake has formed as a result of damming by a large rock avalanche extending across the valley of the mid-upper reaches of the Blue Grey River. Despite the presence of three small islands, the lake is believed to be very deep (at least 90 m) as a result of ice scouring. The Blue Grey River flows out of the lake through an underground outlet running through the now forested avalanche debris. The 46 sq.km catchment is composed of unmodified beech forest and subalpine mountain slopes. The water in the lake is slightly brown due to humic discolouration, and is characteristic of an oligotrophic to slightly mesotrophic mountain lake.
Ecological features: Lake Christabel is the largest lake in New Zealand from which exotic fish are absent. Exotic fish species have been unable to colonize the lake from the Blue Grey River downstream because of the lake's underground outlet. The entire catchment of the lake is within the Lake Christabel Ecological Area (giving it a high level of protection for ecological purposes), and is physically isolated from development. Marginal weed beds are dominated by *Myriophyllum* sp., with *Potamogeton cheesmanii* and *Nitella* sp. The weed beds support an invertebrate fauna of some four mollusc species (*e.g. Potamopyrgus antipodum* and *Sphaerium novaezelandiae*) and ten arthropod species (*e.g. Xanthocnemis zelandica*, *Sigara arguta* and *Chironomus* sp.). Beech (*Nothofagus* spp.) forest extends down to the lake edge.
Land tenure: The lake bed and the entire catchment are Crown land within the Lake Christabel Ecological Area.
Conservation measures taken: The lake and its entire catchment have been designated as an Ecological Area, and are managed by the Department of Conservation. Ecological Area designation gives the area a high level of protection for ecological purposes. The lake is a waterfowl refuge during the hunting season. A report of the Fisheries Management Division in 1974 (Johnson & Mace, 1974) recommended that the lake should not be stocked with species of fish that are not already present.
Conservation measures proposed: Johnson and Mace (1974) also recommended that the lake be declared a Faunistic Reserve. It is not certain why this proposal has not yet been implemented.
Land use: There are no significant uses at the wetland. There is no resident population or land development in the immediate area of the lake, apart from a walking track and a 12-bunk tramping hut. Some deer hunting occurs in the surrounding forest. Land to the east of the lake and up to the lake's western (downstream) shore was part of a pastoral lease, carrying sheep until about 1925.
Possible changes in land use: None foreseen.
Disturbances and threats: None known.
Hydrological and biophysical values: The underground outlet of the lake isolates it somewhat from the Blue Grey River downstream, but the lake is no doubt of some importance for maintaining water levels and clarity for the trout in that river.
Social and cultural values: Mostly outdoor recreation; tramping and deer hunting.

Noteworthy fauna: The most noteworthy aspect of the lake is the absence of exotic fish. Two native fish species occur in the lake, *Galaxias brevipinnis* and *Anguilla dieffenbachii*, both of which possibly reached the lake by travelling across moist ground. Little information is available on the avifauna of the lake, but it is known to be used by Black Shag *Phalacrocorax carbo*, Little Shag *Phalacrocorax melanoleucos*, Paradise Shelduck *Tadorna variegata*, Grey Duck *Anas superciliosa* and New Zealand Scaup *Aythya novaeseelandiae*.
Noteworthy flora: The lake is mostly open water. Marginal aquatic vegetation and the adjoining beech forest are not known to include any threatened species.
Scientific research and facilities: Nothing significant.
Conservation education: Nothing significant.
Recreation and tourism: The area is popular for low impact recreational activities, *e.g.* tramping and deer hunting. There is a walking track around the edge of the lake and a tramping hut at the head.
Management authority: The Department of Conservation (West Coast Conservancy) is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.
Jurisdiction: Territorial: West Coast Regional Council and Buller District Council. Functional jurisdiction for conservation: Department of Conservation.
References: Department of Conservation (1986); Johnson & Mace (1974); Morse (1981); Stengs (1986).
Reasons for inclusion:

1d Lake Christabel is a particularly good example (the largest in New Zealand) of a lake and its associated aquatic communities from which exotic fish are absent. It is also a representative example of an avalanche-dammed lake.

Source: Don Neale and John Lyall.

North Westland Ecological Region Complex (47)

Location: 42°33'S, 171°34'E. Spread over a radius 17.5 km near the township of Moana, West Coast, South Island. In North Westland Ecological Region.
Area: Not applicable.
Altitude: 86-260 m.
Overview: A complex of lakes of fluvio-glacial origin. The principal wetlands (from north to south) are: Lake Hochstetter, Lake Ahaura, Lake Haupiri, Lake Brunner, Lady Lake, Kangaroo Lake and Lake Poerua. All but Lake Poerua are of international significance in their own right, and are therefore described separately as Sites 47a-f. Lake Poerua is of lesser significance, but is included here as the overall integrity of the complex deserves recognition.
Physical features: The lakes are all inland freshwater lakes of fluvio-glacial origin, with water that is stained by organic matter. All the lakes have been affected to varying degrees by human activities.
Ecological features: Open water lakes with swamp and/or forest margins.
Land tenure: Most of the wetland complex is Crown land, except for Lake Haupiri which is 50% Crown land and 50% privately owned land. Most of the lakes are surrounded by Crown land with the exception of Lakes Kangaroo, Lady and Poerua which have varying degrees of privately owned land around them.

Conservation measures taken: The largest of the wetlands, Lake Brunner, is unprotected Crown land. Lake Haupiri is also unprotected. The other wetlands are all Crown land with a variety of protective status including Stewardship Area, Scenic Reserve and Wildlife Management Reserve. These areas are managed by the Department of Conservation.
Conservation measures proposed: No major proposals are known.
Land use: Conservation of flora and fauna, protection of wildlife, and recreational use. There are also limited commercial operations involving harvesting of natural resources from within the complex. Outside the protected areas, agriculture is predominant, with other uses including recreation, harvesting of natural resources and forestry.
Possible changes in land use: No major changes in land use are anticipated at the wetlands, and it appears unlikely that there will be any large-scale changes in the catchment area.
Disturbances and threats: See individual site accounts.
Hydrological and biophysical values: The lakes play a general role in the recharge and discharge of groundwater (acting as water storage reservoirs during heavy rain), the maintenance of water quality and the support of food chains.
Social and cultural values: See individual site accounts.
Noteworthy fauna: The lakes are particularly important for their populations of the endemic Giant Kokopu *Galaxias argenteus* and the Great Crested Grebe *Podiceps cristatus australis*. Lakes Brunner, Hochstetter and Lady are important moulting areas for Paradise Shelduck *Tadorna variegata*.
Fish species recorded in the complex include Long-finned Eel *Anguilla dieffenbachii*, Banded Kokopu *Galaxias fasciatus* and Koaro *Galaxias brevipinnis*. Waterbirds include shags *Phalacrocorax* spp., herons *Egretta* spp., Canada Goose *Branta canadensis*, Grey Duck *Anas superciliosa*, New Zealand Shoveler *A. rhynchotis variegata*, New Zealand Scaup *Aythya novaeseelandiae*, Weka *Gallirallus australis australis*, Marsh Crake *Porzana pusilla affinis*, Pukeko *Porphyrio porphyrio melanotus* and South Island Fernbird *Bowdleria punctata punctata*.
Noteworthy flora: Little is known of the flora of the wetland complex.
Scientific research and facilities: Limited research has been undertaken and no facilities exist.
Conservation education: No facilities exist.
Recreation and tourism: See individual site accounts.
Management authority: The Department of Conservation, Arahura Field Centre, West Coast Conservancy, is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.
Jurisdiction: Territorial: West Coast Regional Council and Grey District Council. Functional jurisdiction for conservation: Department of Conservation, Arahura Field Centre, West Coast Conservancy.
References: See individual site accounts.
Reasons for inclusion:

1a The lakes are a good representative example of a network of fluvio-glacial lakes, a wetland type characteristic of New Zealand.

2a The lakes support populations of two threatened species of fish, *Galaxias argenteus* and *G. fasciatus*.

2b The lakes support populations of several species of fish and birds which are uncommon and/or threatened in New Zealand, *e.g. Podiceps cristatus australis* and *Bowdleria punctata punctata*, and are thus of importance in maintaining the genetic and ecological diversity of the region.

2d The lakes are of special value for their endemic species of fish and birds, including *Galaxias argenteus*, *G. fasciatus*, *Tadorna variegata*, *Aythya novaeseelandiae* and *Bowdleria punctata*.

Source: John Lyall, David Byers, Diana Clendon, Marie Long, Ray Hooker and Don Neale.

Lake Hochstetter (47a)

Location: 42°26'50"S, 171°40'E. 24 km east of Ngahere township, North Westland, West Coast, South Island.
Area: c.800 ha.
Altitude: 260 m.
Overview: Lake Hochstetter is one of a network of fluvio-glacial lakes in this region. The lake and its catchment show a high degree of naturalness in terms of vegetation. The catchment area is relatively unmodified beech forest (*Nothofagus* spp.), and this gives the lake its typical amber coloured waters. The lake is important for Paradise Shelduck *Tadorna variegata* and an endemic fish, the Giant Kokopu *Galaxias argenteus*.
Physical features: A wide range of rock types, reworked glacial deposits and alluvium are found in the area. The lake's geomorphic origin is of a glacial/periglacial nature. The lake is dystrophic and homoiothermic. The high rainfall has caused excessive leaching which has led to a marked decrease in soil fertility. Sixty-five percent of the wetland is open water. The main inflow is by streams, and the major outflow is through Nelson Creek. The water is heavily stained with organic matter which is typical of Westland beech forest lakes. It has a secchi reading of 1 metre minimum and 2.5 metre maximum. The depth of the lake is unknown.
Ecological features: Twenty-five percent of the lake margin has mixed podocarp/beech forest surrounding it. The catchment area (11.10 sq.km) is relatively unmodified beech forest. The lake edge supports dense semi-pakihi vegetation comprising *Eleocharis* spp., *Baumea* spp., *Juncus* spp., *Gleichenia* spp, Wire Rush *Empodisma minus*, New Zealand Flax *Phormium tenax* and *Carex* spp. The majority of the surrounding area is essentially unmodified native vegetation.
Land tenure: The lake and surrounding areas are Crown land.
Conservation measures taken: The lake is Crown land held as Stewardship Area and administered by the Department of Conservation. Similarly, all of the land around the lake is Crown land managed by the Department of Conservation. To the northwest of the lake, but not adjoining it, is the Hochstetter Ecological Area, also managed by the Department of Conservation. The purpose of an ecological area is to protect the area for its ecological values. An extension to this ecological area has been approved, and is awaiting gazettal. This extension includes some of the land surrounding the lake, and will extend around approximately one third of the lake shore.
A large portion of the catchment to the north and east is an area provisionally set aside for "wildlife corridor purposes", to act as a link between the Lake Hochstetter Ecological Area and other ecological areas to the east and the north (*e.g.* Bywash Creek Pakihi, Flagstaff). The southern margin is within the wildlife corridor, but adjoining land is managed for timber production by the Crown-owned Timberlands (West Coast) Limited.
Conservation measures proposed: Gazettal procedures will shortly be initiated for the approved extension to the Lake Hochstetter Ecological Area. The wildlife corridor portion was

subject to a five year research programme, completed in December 1991. Proposals for more secure legislative status are likely.

Land use: Conservation of flora and fauna and protection of wildlife at the principal activities at the lake and in surrounding areas. Some harvesting of sphagnum moss occurs on a permit basis, over a large area at the southern end of the lake and over a small area at the northern end of the lake. Recreational activities include trout fishing, duck hunting, picnicking and walking. Limited recreational activities occur in the catchment area, and there is some deer hunting in the neighbouring forests. There are some plantation forests to the north of the lake and in the proposed Ecological Areas.

Possible changes in land use: Harvesting of exotic timber is likely in the Timberlands land to the south.

Disturbances and threats: The lake is relatively isolated, and disturbances and threats are not well known. Present harvesting of sphagnum moss could threaten its future.

Hydrological and biophysical values: The lake plays a general role in the recharge and discharge of groundwater, the maintenance of water quality and the support of food chains. It acts as a flood storage during heavy rain, and reduces flooding in Nelson Creek.

Social and cultural values: Harvesting of sphagnum moss, duck shooting, picnicking, walking and deer hunting in the adjoining forests. There are no known sites relating to pre-European settlement.

A large earth and rock-faced dam was constructed in 1875 to 1878 to store water to supply the Nelson Creek water-race for gold-mining around Hatters and Try Again Terraces. The dam headworks are largely intact. A second dam and headworks were constructed in the 1930s to provide water to another gold mining-venture in Callaghans Creek. Considerable amounts of Silver Pine *Lagarostrobus colensoi* have been logged around the margins of the lake, and the associated tramlines remain.

Noteworthy fauna: The lake supports good numbers of Giant Kokopu *Galaxias argenteus* and Long-finned Eel *Anguilla dieffenbachii*. Other native fish living in the lake and its tributaries are Banded Kokopu *Galaxias fasciatus* and Koaro *G. brevipinnis*.

The lake is not used extensively by waterfowl, but between 100 and 500 Paradise Shelduck *Tadorna variegata* use it as a moulting site. Other birds recorded on the lake and in the adjoining wetland include Great Crested Grebe *Podiceps cristatus australis* (endangered in New Zealand), shags *Phalacrocorax* spp., herons *Egretta* spp., Canada Goose *Branta canadensis*, Grey Duck *Anas superciliosa*, New Zealand Shoveler *Anas rhynchotis variegata*, Weka *Gallirallus australis australis*, Pukeko *Porphyrio porphyrio melanotus* and South Island Fernbird *Bowdleria punctata punctata*.

Noteworthy flora: No survey of threatened plant species has been undertaken. The wetland plant communities are of good quality, and the majority of the surrounding areas are basically unmodified except for the past logging of Silver Pine *Dacrydium colensoi*.

Scientific research and facilities: No facilities currently exist.

Conservation education: There are no programmes at present.

Recreation and tourism: Recreation is very much of a local nature, with some deer hunting, walking, picnicking, trout fishing and duck shooting being the most common activities.

Management authority: The Department of Conservation, Arahura Field Centre, West Coast Conservancy, is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.

Jurisdiction: Territorial: West Coast Regional Council and Grey District Council. Functional jurisdiction for conservation: Department of Conservation, Arahura Field Centre, West Coast Conservancy.

References: Department of Conservation (1986); Hughes (1975); Livingston *et al.* (1986b); Morse (1981).

Reasons for inclusion:

1a Lake Hochstetter is a good representative example of a fluvio-glacial lake, a wetland type characteristic of New Zealand. Along with Lakes Brunner, Ahaura, Kangaroo, Haupiri and Lady, Lake Hochstetter forms part of a large complex of fluvio-glacial lakes.

2a The lake supports populations of two threatened species of fish, *Galaxias argenteus* and *G. fasciatus*.

2b The lake supports populations of several species of fish and birds which are uncommon and/or threatened in New Zealand, *e.g. Podiceps cristatus australis* and *Bowdleria punctata punctata*, and is thus of importance in maintaining the genetic and ecological diversity of the region.

2d The lake is of special value for its endemic species of fish and birds, including *Galaxias argenteus*, *G. fasciatus*, *Tadorna variegata* and *Bowdleria punctata*.

Source: John Lyall, David Byers, Diana Clendon, Ray Hooker and Don Neale.

Lake Ahaura (47b)

Location: 42°33'S, 171°44'E. 68 km northeast of Hokitika, West Coast, South Island.

Area: c.240 ha.

Altitude: 247 m.

Overview: Lake Ahaura is part of a network of fluvio-glacial lakes (including Lakes Brunner, Kangaroo, Haupiri Lady, and Hochstetter) typical of the West Coast. Its organically-stained waters and low productivity are typical of beech (*Nothofagus* spp.) forest lakes. The catchment is relatively unmodified, and the lake supports two nationally threatened species and a small population of ducks.

Physical features: The lake is of glacial/periglacial origin, and was formed by a river that was blocked behind a large moraine. The main inflow is from approximately nine surface streams of similar size; the main outflow is via a creek to the Haupiri River. The maximum depth of the lake is 33 m. The lake has a pH of nearly neutral, and the water is heavily stained with dissolved organic matter derived from the beech forest. A secchi disc reading of 2.9 m has been obtained. The lake is dystrophic with low aquatic productivity and only minute stocks of biologically available phosphorus. A thermocline occurs at a depth of 15 metres. The catchment area is relatively small (13.15 sq.km). Due to the high rainfall, the soils are excessively leached and of low fertility.

The average annual rainfall is approximately 1,919 mm, and equates to 186 wet days per year. The temperature is described as mild.

Ecological features: A zone of rushes *Baumea* spp. occurs on the narrow neck of the lake. Over 85% of the catchment area is relatively unmodified beech forest (*Nothofagus* spp.), and only a small proportion is in plantations of pines *Pinus* spp. Special features of the lake are the unmodified lake edge and catchment, and the absence of exotic species of trout *Salmo* spp.

Land tenure: The lake and the majority of the surrounding catchment are Crown land. The remaining land is freehold.

Conservation measures taken: The lake and its catchment have been designated as Stewardship Area and are managed by the Department of Conservation. Stewardship Areas are to be managed so that their natural and historic resources are protected.

Conservation measures proposed: None known.
Land use: Land use at the wetland is very limited, as there is no road access to the lake. Little information is available on land use, but limited duck hunting does occur. Small parts of the catchment are used for plantation forestry, with *Pinus* species being the crop. Hunting for Red Deer *Cervus elaphus* occurs in the forested areas.
Possible changes in land use: None anticipated.
Disturbances and threats: The lake is relatively isolated, and appears to be under little threat. Should plantation forestry ever increase in the areas surrounding the lake, then increased eutrophication may result. Harvesting of eels, unless strictly controlled, may lead to stock depletion.
Hydrological and biophysical values: The lake plays a general role in the recharge and discharge of groundwater, the maintenance of water quality and the support of food chains.
Social and cultural values: Limited recreational activities occur, with duck shooting on the lake and hunting in the surrounding forest.
Noteworthy fauna: The lake is of particular interest for its breeding population of Great Crested Grebe *Podiceps cristatus australis* (endangered in New Zealand) and population of Giant Kokopu *Galaxias argenteus*. Other waterbirds include a variety of ducks (Anatidae), and other fish include the Common Bully *Gobiomorphus cotidianus*, Koaro *Galaxias brevipinnis* and Long-finned Eel *Anguilla dieffenbachii*.
Noteworthy flora: Little information is available on the flora of the wetland, and no particularly noteworthy species have been recorded.
Scientific research and facilities: None.
Conservation education: None.
Recreation and tourism: Limited duck shooting occurs on the lake, and there is some deer hunting in the surrounding areas, otherwise no other recreational activities have been recorded, possibly due to the poor access.
Management authority: The Department of Conservation, Arahura Field Centre, West Coast Conservancy, is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.
Jurisdiction: Territorial: West Coast Regional Council and Grey District Council. Functional jurisdiction for conservation: Department of Conservation, Arahura Field Centre, West Coast Conservancy.
References: Department of Conservation (1986); Hughes (1975); Livingston *et al.* (1986b); Morse (1981).
Reasons for inclusion:

1a Lake Ahaura is a good representative example of a fluvio-glacial lake, a wetland type characteristic of New Zealand. Along with Lakes Brunner, Lady, Kangaroo, Haupiri and Hochstetter, Lake Ahaura forms part of a large complex of fluvio-glacial lakes.
2a The lake supports a population of a threatened species of fish, *Galaxias argenteus*.
2c The lake provides breeding habitat for *Podiceps cristatus australis*.
2d The lake is of special value for its endemic species of fish, including *Galaxias argenteus*.

Source: Diana Clendon, John Lyall, Don Neale and David Byers.

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Lake Haupiri (47c)

Location: 42°34'S, 171°41'E. 65 km northeast of Hokitika and 40 km east-southeast of Greymouth, West Coast, South Island.
Area: 323.64 ha.
Altitude: 190 m.
Overview: Lake Haupiri is part of a network of fluvio-glacial lakes (including Lakes Ahaura, Brunner, Kangaroo, Lady and Hochstetter). It has areas of open water and a swampy lake margin offering a high value habitat for a variety of wetland species. The primary value of this wetland is for wildlife conservation.
Physical features: Lake Haupiri is of glacial origin, and was formed at the termination of a lobe of the Otira glacial advance. Underlying material is glacial till. The soils are very poorly drained and peaty, and are organically derived from New Zealand Flax *Phormium tenax* and Kahikatea *Dacrycarpus dacrydioides* with some alluvium. The lake is fed by seven tributaries, and acts as a flood water storage reservoir in times of high rainfall.
Ecological features: The lake and surrounding swamp provide high value habitat for a variety of waterfowl and other wetland birds. Burning and grazing in the past have removed much of the original vegetation, but these areas are now regenerating. Some 45% of the wetland is open, burnt and grazed marshland; 20% comprises remnant forest stands, and 15% comprises typical wetland vegetation and grasses. The remaining 20% of the wetland is a combination of pakihi, a dense sward of flax, an area of trampled flax and a thin band of vegetation along the lake margin including Manuka *Leptospermum scoparium*, Yellow-silver Pine *Lepidothamnus intermedius* and New Zealand Flax.
Land tenure: The lake bed and less than 50% of the surrounding wetland is Crown land. The remainder of the wetland is freehold in private ownership. To the north of the wetland, the land is Crown land managed by the Department of Conservation and designated as stewardship area. The areas to south and west are freehold in private ownership.
Conservation measures taken: The lake bed and less than 50% of the surrounding wetland is Crown land managed by the Department of Conservation, and currently designated as Wildlife Management Reserve. To allow formal protection, the wetland was gazetted as a Wildlife Refuge in 1957, and then reclassified as a Wildlife Management Reserve in 1986. Areas of the reserve have been fenced to exclude domestic livestock. Other areas of the reserve have been grazed to make the habitat more suitable for some species of waterfowl.
Lake levels have been maintained and a "Class C" standard of water quality is maintained, as set out in the Water and Soil Conservation Act 1967. The quality of Class C waters shall conform to the following requirements:

- the natural water temperature shall not be changed by more than 3 degrees celsius;
- the acidity or alkalinity of the waters as measured by the pH shall be within the range 6.5 to 8.3 except when due to natural causes;
- the waters shall not be tainted so as to make them unpalatable, nor contain toxic substances to the extent that they are unsafe for consumption by humans or farm animals, nor shall they emit objectional odours;
- there shall be no destruction of natural aquatic life by reason of a concentration of toxic substances;
- the natural clarity and colour of the waters shall not be changed to a conspicuous extent;
- the oxygen content in solution in the waters shall not be reduced below 6 milligrams per litre;

- based on not fewer than 5 samples taken over not more than a 30 day period, the median value of the faecal coliform bacteria content of the waters shall not exceed 200 per 100 millimetres.

Conservation measures proposed: The management plan for Lake Haupiri Wildlife Management Reserve recommends that introduced mammals and plants should be controlled within the reserve.

Land use: The wetland is a popular recreation area for angling, boating, water-skiing, informal camping and game-bird hunting. Grazing occurs on the southern and western sides of the wetland. The surrounding areas are part of a pastoral enterprise, and grazing occurs in these areas.

Possible changes in land use: Grazing in the western areas may eventually be stopped. Recreational use may change in the future, but as yet this is undecided. The predominant use in the surrounding areas is farming, but it is very likely that there will be an intensification of activities in the area, with farming being replaced with commercial aircraft servicing and light manufacturing.

Disturbances and threats: Natural flooding will occur as weather conditions dictate, and this will alter the physical characteristics of the site. Harvesting of eels *Anguilla* sp. for commercial gain may seriously threaten the eel population as well other native fish stocks through incidental take. Introduction of the Brown Trout *Salmo trutta* in the 1800s has almost certainly affected native fish stocks, but to what degree is not known. Introduced plants, especially Gorse *Ulex europaeus* and Blackberry *Rubus fruticosus*, threaten native plants. Introduced mammals pose threats to the indigenous fauna of the wetland. Fires and land drainage in the surrounding freehold land will change the character of the wetland within the reserve. Finally, there may be some eutrophication as a result of farming practices on adjacent land.

Hydrological and biophysical values: The lake acts as a flood water storage reservoir.

Social and cultural values: The wetland has high social values because of the variety of recreational activities that occur there. No archaeological or historic sites have been recorded in the area, but it is likely to have been a stopover point on the Amuri Pass route to Canterbury.

Noteworthy fauna: The lake supports a large number of Paradise Shelduck *Tadorna variegata*; counts in 1984 and 1987 indicated that an estimated 30% of the regional population were present at the lake during the moulting season. The Great Crested Grebe *Podiceps cristatus australis* has been recorded at the lake, along with other notable species such as the New Zealand Scaup *Aythya novaeseelandiae*, Marsh Crake *Porzana pusilla affinis* and South Island Fernbird *Bowdleria punctata punctata*. The lake supports a large population of the Giant Kokopu *Galaxias argenteus*, as well as Koaro *G. brevipinnis* and the freshwater mussel *Diplodon* sp.

Noteworthy flora: No threatened species of plants have been recorded, but there are good forest stands of Kahikatea *Dacrycarpus* sp., Mountain Beech *Nothofagus* sp. and Red Beech in the area.

Scientific research and facilities: None.

Conservation education: None.

Recreation and tourism: Recreation is low key, with game-bird hunting and angling being the predominant activities. There are also low levels of use for camping, picnicking and boating. Unrestricted foot access is permitted. The only camping facilities available are a toilet and fireplace.

Management authority: The Department of Conservation, Arahura Field Centre, West Coast Conservancy, is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for

water resources. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.
Jurisdiction: Territorial: West Coast Regional Council and Grey District Council. Functional jurisdiction for conservation: Department of Conservation, Arahura Field Centre, West Coast Conservancy.
References: Department of Conservation (1986); Livingston *et al.* (1986b); Tonks (1988).
Reasons for inclusion:

1a Lake Haupiri is a good representative example of a fluvio-glacial lake, a wetland type characteristic of New Zealand. Along with Lakes Ahaura, Brunner, Lady, Kangaroo and Hochstetter, Lake Haupiri forms part of a large complex of fluvio-glacial lakes.

2a The lake supports a large population of a threatened species of fish, *Galaxias argenteus*.

2c The lake is an important moulting area for Paradise Shelduck *Tadorna variegata*.

2d The lake is of special value for its endemic species of fish and birds, including *Galaxias argenteus*, *Tadorna variegata*, *Aythya novaeseelandiae* and *Bowdleria punctata*.

Source: Diana Clendon, Don Neale and John Lyall.

Lake Brunner (47d)

Location: 42°37'S, 171°27'E. Immediately south of Moana, Westland, South Island.
Area: c.3,610 ha.
Altitude: 86 m.
Overview: Lake Brunner is part of a network of fluvio-glacial lakes (including Lakes Ahaura, Kangaroo, Haupiri, Lady and Hochstetter). It is an important Westland beech forest lake with a wide swampy margin which provides good breeding and feeding habitat for a variety of wetland birds. The lake is part of complex of glacio-fluvial lakes, a wetland type characteristic of New Zealand.
Physical features: Lake Brunner occupies the trough of a Pleistocene glacier that flowed through from the Taramakau River in the south. The surrounding flats are recent river gravels, with some glacial till (Moana Formation) at the northern end. The lake has a maximum recorded depth of 109 m. It is fed by two main rivers, the eastern Hohonu and the Crooked, and another dozen smaller creeks, and is drained by the Arnold River into the Grey River. A high seasonal rainfall and large catchment (380 sq.km) can cause the water level in the lake to change by up to 2.1 m. The lake is heavily stained by natural humic discolouration from the surrounding beech forest.
Ecological features: Lake Brunner is a lowland lake with indigenous podocarp/hardwood forest around two-thirds of its margin. The remainder of the margin is a large associated swamp dominated by willow *Salix* spp. and *Carex gaudichaudiana*, with other wetland swamp species such as New Zealand Flax *Phormium tenax*, *Juncus* spp. and *Baumea* spp. present. The marginal lake vegetation grades back into indigenous Kahikatea *Dacrycarpus dacrydioides* swamp. Aquatic plants such as *Nitella* spp. and *Chara* spp. are common in shallow water.
Land tenure: The lake and its margins are a mixture of public land (unprotected Crown land and legal road managed by local authorities) and private land. Most of the land to the southeast and southwest of the lake is Crown land. Other land surrounding the lake is privately owned.

Conservation measures taken: Most of the land to the southeast and southwest of the lake is protected as Scenic Reserves. These reserves are managed by the Department of Conservation under the Reserves Act 1977. The reserves are as follows:

- Lake Brunner S.R. 374 ha, gazetted in 1979. Along parts of the southern and eastern shore, from Mitchells to Camp Point, Carew Bay to Dobson Bay, and at Uncle Bay.
- Mount Te Kinga S.R. 3,945 ha, gazetted in 1979. On the western shore of the lake.
- Arnold River S.R. 339 ha, gazetted in 1978. At the outlet of the lake, where the Arnold river starts, and further downstream.
- Refuge Island S.R. 0.6 ha, gazetted in 1978. On islands in the lake.
- Moana S.R. 52 ha, gazetted in 1978. A short distance from the lake, to the north of the township of Moana.

Control of willow *Salix* sp. has been carried out on some of the lake shores and along the Arnold River. Jet-boating is prohibited for most of the year along the Crooked River to protect trout-spawning areas, with dispensation being given for a short period each year because of the high quality jet-boating that the river provides.

Conservation measures proposed: Two areas of privately owned land (Tasman Forestry Ltd.) are proposed for conservation covenants under the Tasman Accord agreement. These are: on the northwestern shore, from Dobson Bay to the Arnold River; and part of the Hohonu Forest at the southern end of the lake.

Land use: The lake is a very popular recreation area, and is used for swimming, camping, boating, fishing and duck hunting. There is road access to the lake at Moana, Iveagh Bay and Mitchells. The Scenic Reserves are devoted to the conservation of flora and fauna and protection of wildlife, and there are large areas of protected forest to the west and south of the lake. The major land use on private land is farming; primarily of cattle and sheep, with some Red Deer *Cervus elaphus*. Residential development with direct access to the lake is limited to three settlements, at Moana, Iveagh Bay and Mitchells. Each of these has a small resident population, but numbers swell during the peak summer period. The Arnold River, and to a lesser extent the Grey River, are very popular rivers for trout fishing and kayaking.

Possible changes in land use: At present, the administering bodies are undertaking a joint resource study for Lake Brunner and its catchments, with the intention of developing a management plan for the area. Changes that will result from this are not yet determinable.

Disturbances and threats: The invasion of large areas of the lake shore and river banks by willows *Salix* spp. has greatly affected the natural values of the lakeside vegetation, particularly in the vicinity of the Crooked River inflow. Problems exist with the seepage of effluent into the lake; the camping ground at Iveagh Bay was closed in the 1970s for this reason. Campers along the western beaches also cause problems with careless waste disposal. Rubbish tips at Moana and Mitchells are in stream valleys that feed into the lake; the impact of these has not yet been ascertained. Jet-boating is prohibited in the Crooked River to protect trout spawning areas, but is known to occur illegally. Jet-boats and jet-skis can also interfere with other activities and values associated with the lake. Land slips and flooding problems occur at the southern end of the lake, and affect land development there.

Hydrological and biophysical values: The lake is a very important natural water reservoir for the Arnold River power station. It is also important to the floodwater levels of the Arnold and Grey Rivers, the latter of which has historically caused major flood problems to its adjoining farmland and settlements. The lake plays a general role in the recharge and discharge of groundwater, the maintenance of water quality and the support of food chains.

Social and cultural values: The area in general is an important recreational resource for the region and outlying areas. Lake Brunner (or Kotukuwakaoka) has a long historical association with both Maori and Europeans. It was on a route to the east via the Hurunui pass used by Maori and early European travellers. Maori settlements around Pah Point and Refuge Islands

were reported by European explorers. This is supported by Maori oral traditions and physical evidence of occupation. In season, eels *Anguilla* spp., ducks *Anas* spp. and Weka *Gallirallus australis* were gathered at Lake Brunner. The Refuge Islands (Taka Taka and a smaller island) are recorded as archaeological sites, as is Pah Point to the north. Other pre-European archaeological sites are recorded on the west side of the lake near Hohonu Spit and at the northern end near the lake's outlet. There are wharf and skid remains together with tramways and relics dating from the 1920s at Bain Bay. The forest to the west of the lake was logged and the logs hauled to the lake then rafted across to the Moana mill.

Noteworthy fauna: The lake is a breeding area for Anatidae, including Black Swan *Cygnus atratus* and ducks *Anas* spp., and is a moulting area for Paradise Shelduck *Tadorna variegata*. Two exotic fish, the Brown Trout *Salmo trutta* and Rainbow Trout *Oncorhynchus mykiss*, are abundant in the lake, and support an important recreational fishery.

Noteworthy flora: None known.

Scientific research and facilities: Studies are often undertaken on trout numbers by the West Coast Fish and Game Council.

Conservation education: The ease of access and popularity of the lake for recreation gives it a high potential for conservation education. The "Tasman Accord" forest area at the Arnold River outlet is being developed into a walkway and environmental interpretation area.

Recreational and tourism: During the summer months, recreational activity is high, especially boating, kayaking, swimming, game-bird hunting and fishing, but land-based activities such as walking and tramping are also popular. The development of tourism is limited by a lack of facilities such as camping areas and shops. Some current and potential recreational activities are likely to conflict with other uses (*e.g.* jet-boating).

Management authority: The Department of Conservation, Arahura Field Centre, West Coast Conservancy, is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.

Jurisdiction: Territorial: West Coast Regional Council and Grey District Council. Functional jurisdiction for conservation: Department of Conservation.

References: Department of Conservation (1986); Morse (1981); Wardle (1981).

Reasons for inclusion:

1a Lake Brunner is a representative example of a fluvio-glacial lake, a wetland type characteristic of New Zealand. Along with Lakes Lady, Kangaroo, Haupiri, Ahaura and Hochstetter, Lake Brunner forms part of a large complex of fluvio-glacial lakes.

Source: Marie Long, David Byers, Diana Clendon, Don Neale, Ray Hooker and John Lyall.

Lady Lake (47e)

Location: 42°36'S, 171°34'50"E. Approximately 9 km from the township of Moana, Westland, South Island.

Area: c.378 ha.

Altitude: 112 m.

Overview: Lady Lake is a small shallow body of water of which 50% is open water and the remainder is swampy flats. The lake supports populations of a number of species of waterfowl, including endemic and indigenous species, and the endemic Giant Kokopu *Galaxias*

argenteus. The Lake is part of a complex of glacio-fluvial lakes (including Lakes Ahaura, Kangaroo, Haupiri, Brunner and Hochstetter), a wetland type characteristic of New Zealand.

Physical features: Lady Lake is a glacially formed lake enclosed by a moraine of the Moana Formation of the Otira Glaciation. The catchment area (excluding the lake) is 16.66 sq.km. The soils of the lake margins are of organic and alluvial origins. The lake has a maximum depth of 26 m (Livingston *et al.*, 1986b). The water is heavily stained by organic matter (mean secchi disk depth 3.4 m), and is dystrophic with a thermocline at 12 m. The main surface inflow is via Lady Creek; outflow is via the Crooked River.

Ecological features: About 50% of the lake is open water with some submerged and marginal vegetation. Some 22% is swamp dominated by New Zealand Flax *Phormium tenax*, *Leptocarpus* spp., *Carex* spp. and other swamp plants. *Coprosma* shrubs, *Typha* spp. and manuka occur in small quantities. About 7% of the area is dense stands of Kahikatea *Dacrycarpus dacrydioides*, while 20% is forest dominated by Rimu *Dacrydium cupressinum* and Miru *Prumnopitys ferruginea*, with an understorey of Kamahi *Weinmannia racemosa* and Quintinia *Quintinia acutifolia*. The remaining 1% is forest dominated by Kahikatea and Matai *P. taxifolia* on alluvial flats, with an understorey of Pepper Tree *Pseudowintera colorata* and *Neomyrtus* sp.

Land tenure: The lake bed and surrounding margins are Crown land. Adjacent areas are predominately Crown land with various protective status, but there is an area of private land in the south.

Conservation measures taken: Lady Lake is protected as a Scenic Reserve. Crown land to the west of the lake has also been gazetted as Scenic Reserve. To the northwest and east, there is a small strip of Crown land on the lake side which is conservation area administered by the Department of Conservation. This area acts as a buffer between the lake and Crown land controlled by Timberlands Ltd. a state-owned enterprise.

Conservation measures proposed: None known.

Land use: Conservation of flora and fauna, protection of wildlife and recreational hunting, fishing and boating are the main activities in the Scenic Reserves. The main land use on the private land to the south of the lake is dairy and cattle farming. Some recreational activities, including deer hunting, occur in the forest areas, but the exact nature of these activities is not well known.

Possible changes in land use: None known.

Disturbances and threats: There is a possible threat from drainage and development of the adjoining freehold swampland to the south of the lake. This would affect the vegetation around the lake and decrease the size of the lake itself, thus changing the nature and quality of the habitats.

Hydrological and biophysical values: The lake plays a general role in the recharge and discharge of groundwater, the maintenance of water quality and the support of food chains. The lake acts as a flood storage area in times of high rainfall.

Social and cultural values: The wetland is used for recreational hunting and fishing during the appropriate seasons.

Noteworthy fauna: Lady Lake supports a breeding population of Black Swan *Cygnus atratus* and ducks *Anas* spp., and is a moulting area for Paradise Shelduck *Tadorna variegata*. The Giant Kokopu *Galaxias argenteus* is found in the lake, along with the introduced Brown Trout *Salmo trutta*.

Noteworthy flora: No species of particular note have been reported. However, the wetland includes a large area of intact swampland associations representative of the West Coast.

Scientific research and facilities: Several studies have been carried out on plant fossils found beneath the lake (Drake & Burrows, 1980).

Conservation education: None.

Recreation and tourism: Recreational duck shooting and angling occur at the lake. The high quality of the scenery gives the area some value for tourists. Boating is permitted on the lake.
Management authority: The Department of Conservation, Arahura Field Centre, West Coast Conservancy, is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.
Jurisdiction: Territorial: West Coast Regional Council and Grey District Council. Functional jurisdiction for conservation: Arahura Field Centre, Department of Conservation (West Coast Conservancy).
References: Department of Conservation (1986); Department of Lands and Survey (1981b); Drake & Burrows (1980); Livingston *et al.* (1986b).
Reasons for inclusion:

1a Lady Lake is a good representative example of a fluvio-glacial lake, a wetland characteristic of New Zealand. Along with Lakes Brunner, Ahaura, Kangaroo, Haupiri and Hochstetter, Lady Lake forms part of a large complex of fluvio-glacial lakes.
2a The lake supports a population of a threatened species of fish, *Galaxias argenteus*.
2c The lake is a moulting area for Paradise Shelduck *Tadorna variegata*.

Source: David Byers, Diana Clendon, John Lyall and Don Neale.

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Kangaroo Lake (47f)

Location: 42°37'S, 171°33'E. 6.5 km southeast of Moana township, North Westland, West Coast, South Island.
Area: c.200 ha.
Altitude: 99 m.
Overview: Kangaroo Lake is part of a network of fluvio-glacial lakes (including Lakes Ahaura, Brunner, Haupiri, Hochstetter and Lady), a wetland type characteristic of New Zealand. It is a Westland beech forest lake with a wide swampy margin which provides good feeding and breeding habitat for a variety of wetland birds.
Physical features: The lake is glacial in origin, and has a catchment area of 6.05 sq.km. It is fed by eight surface streams, but there is no apparent surface outflow. The lake is dystrophic, and a thermocline occurs at 3.5 m. The water has a pH of near neutral, and is stained brown by suspended organic matter. The average annual rainfall in the area is approximately 1,919 mm, and there are, on average, 186 wet days per year. Temperatures are mild.
Ecological features: The wetland has a relatively high ecological value. About 65% of the lake is open water. Forest surrounds 33% of the lake margin, the remainder being a large swamp comprised of Raupo *Typha orientalis*, *Eleocharis* sp., *Carex* spp., *Juncus* spp., *Leptocarpus* sp., *Lepidosperma* sp., New Zealand Flax *Phormium tenax*, *Coprosma* spp., Manuka *Leptospermum scoparium* and Kahikatea *Dacrycarpus dacrydioides*. The catchment area is predominantly mixed beech/podocarp forest and lowland scrub.
Land tenure: The wetland is Crown land. A legal road surrounds the lake; otherwise the catchment area is freehold land.
Conservation measures taken: The wetland has been gazetted as Stewardship Area.
Conservation measures proposed: None known.

Land use: Some duck shooting occurs at the lake, and there is some agriculture in surrounding areas.
Possible changes in land use: Increased recreational use at the lake; possible increase in agricultural activities in the catchment area.
Disturbances and threats: None known.
Hydrological and biophysical values: The lake acts as a natural water storage reservoir in times of flood.
Social and cultural values: The main social value of the lake is in the recreational opportunities that it provides.
Noteworthy fauna: A large number of waterbirds have been recorded at the lake, including the Australasian Bittern *Botaurus poiciloptilus* and South Island Fernbird *Bowdleria punctata punctata*, both of which prefer a relatively wide swamp zone. Other species present include shags *Phalacrocorax* spp., herons *Egretta* spp., Black Swan *Cygnus atratus*, Mallard *Anas platyrhynchos*, Grey Duck *A. superciliosa*, New Zealand Shoveler *A. rhynchotis variegata*, New Zealand Scaup *Aythya novaeseelandiae* and Pukeko *Porphyrio porphyrio melanotus*.
Noteworthy flora: The wetland has a relatively high ecological value because of its high diversity of plants and the relatively intact nature of its plant communities.
Scientific research and facilities: None.
Conservation education: None.
Recreation and tourism: Some game-bird hunting in season.
Management authority: The Department of Conservation, Arahura Field Centre, West Coast Conservancy, is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.
Jurisdiction: Territorial: West Coast Regional Council and Grey District Council. Functional jurisdiction for conservation: Department of Conservation, Arahura Field Centre.
References: Bell (1986a); Department of Conservation (1986); Hughes (1975); Livingston *et al.* (1986b); Morse (1981).
Reasons for inclusion:

1a Lake Kangaroo is a good representative example of a fluvio-glacial lake, a wetland characteristic of New Zealand. Along with Lakes Brunner, Lady, Ahaura, Haupiri and Hochstetter, Lake Kangaroo forms apart of a large complex of fluvio-glacial lakes.

2a The lake supports a small population of a globally threatened species of bird, *Botaurus poiciloptilus*.

Source: Diana Clendon, John Lyall and Don Neale.

Groves Swamp and Harman Swamp (48)

Location: Harman, 42°45'S, 170°51'E; Groves, 42°51'S, 170°56'E. 11.5 km northeast of Ross, South Westland, West Coast, South Island.
Area: Groves, c.700 ha; Harman c.25 ha.
Altitude: 15 m.
Overview: Groves Swamp and Harman Swamp are two closely inter-connected, flat, low altitude freshwater swamps adjacent to Hokitika River. The two swamps are in a semi-natural condition and together represent a major wetland resource of high value for nature conservation and recreation. The two swamps are separated by a low moraine.

Physical features: The origin of the two swamps dates from the final retreat stages of the Hokitika River glaciers of the Otira glaciation, about 14,000 years ago. The two swamps have developed in an impoundment between the Hokitika River in the east and high glacial moraines to the north, west and south. Harman Swamp is probably a little older than Groves. The two are separated by a single low moraine about 10 m high above the swamp, which represents a minor standstill during a major glacial retreat. Prior to human modification, the two swamps were linked by Pukaki Lagoon through a 15 m gap in the low moraine wall. Groves and Harman Swamps have a catchment area of 1,760 ha. Shooting Creek is the largest stream entering the swamps, but there are also many small streams feeding the wetland. Peat swamp and peat vegetation have developed over post-glacial time, and now there is a depth of about 4 m of peat. The basement at 4 m is a very wet grey silt. The swamps have been subject to flooding and sediment deposition by the Hokitika River, processes which rejuvenate the swamp system. During floods, the two swamps formerly acted as part of an overflow channel for the Hokitika River via Mirror Creek into Lake Mahinapua, and perhaps acted as a buffering system for peak water volumes in the river; the gap in the low moraine wall has now been dammed to prevent flooding and bridge damage in Mirror Creek.

Ecological features: The predominant vegetation in Grove Swamp is an intricate mosaic of various low swamp communities dominated by rushes *Juncus* spp., sedges *Baumea* spp., *Carex* spp., *Lepidosperma australe* and *Leptocarpus similis*, Raupo *Typha orientalis* and New Zealand Flax *Phormium tenax*. These communities, which cover almost 90% of the swamp, are characterised by standing water at the base of the vegetation. The remainder of Groves Swamp is principally Kahikatea *Dacrycarpus dacrydioides* swamp forest and shrub-flax associations (about 10% area) and open water. A total of 128 plant species has been recorded, but this list is incomplete. The floristic diversity of peatlands is normally low because the roots of all peatland plants must be adapted to tolerate an anaerobic environment which is often very acidic and of low nutrient status. The presence of more than 60 plant species growing on the peat is indicative of the high natural value of Grove Swamp. The swamp vegetation is in a semi-natural state, but there is evidence of past modifications. There are two uncommon plants, *Coprosma "filifolia"* and *Olearia virgata* var. *laxiflora*, in Groves Swamp, and as many as four others may be present. The presence of the other rare plants is strongly indicated by their confirmed occurrence in a nearby wetland only 8 km away. These rare species are *Myriophyllum robustum*, *Bulbinella modesta*, *Sparganium subglobosum* and *Epilobium gunnianum.*

The major extent of Harman Swamp is distinctly different from Groves Swamp. Harman is more advanced successionally than Groves because it has not been as frequently rejuvenated by deposition of unweathered deposits during floods from the Hokitika River. There is strong evidence that most of the present vegetation has been induced by burning, and has replaced a former swamp forest. The only open water in the swamp is in the far east corner, and it is probable that only in this vicinity is the vegetation anywhere near its natural pre-European condition. In general, Harman Swamp lacks the ecological and floristic diversity of Groves Swamp. Only five plant communities are identified (dominated by *Eleocharis sphacelata*, New Zealand Flax-*Baumea rubiginosa*, Kahikatea-Flax, Gorse-Flax, and Flax-*Gahnia rigida*); the latter two are induced. Many of the characteristic swamp plants common in Groves Swamp are absent from Harman, and others, *e.g. Viola lyallii* and *Coprosma "filifolia"*, are infrequent.

Land tenure: Both wetlands are Crown land administered by the Department of Conservation. The surrounding areas are a mixture of private land (mostly freehold) and state-owned enterprises (mostly freehold, indigenous production forests to be retained in Crown ownership).

Conservation measures taken: Both wetlands have been gazetted as Stewardship Area and are administered by the Department of Conservation.
Conservation measures proposed: The area has been considered for some time as warranting a more secure protection status.
Land use: The wetlands are used for recreational activities, primarily hunting and scenic appreciation. Harvesting of sphagnum moss is undertaken on small adjoining wetlands, but not at Groves and Harman Swamps. Historically the swamps were used for flax harvesting; this industry is no longer present in New Zealand. Commercial eeling is carried out on a sporadic basis. The predominant use of the surrounding areas is indigenous forestry and agriculture (sheep and cattle farming).
Possible changes in land use: None known.
Disturbances and threats: The most likely disturbances and threats are grazing, weed infestation and ponding. In the past, a number of drains were put in to facilitate flax harvesting and mining, but further drainage of the wetlands is now unlikely to occur. Commercial harvesting of eels *Anguilla* spp. has occurred, and if the level of eeling increases, this could affect the eel population.
Hydrological and biophysical values: During floods, the two swamps formerly acted as part of an overflow channel for the Hokitika River via Mirror Creek into Lake Mahinapua. A dam across the wetlands to prevent damage to the State Highway and bridge now prevent this.
Social and cultural values: The swamps are popular for outdoor recreational, mainly hunting and scenic appreciation.
Noteworthy fauna: Twenty-two species of birds have been recorded at the wetlands during limited surveys of the wetlands. The majority of these were recorded in the kahikatea forest. Species of particular interest present or likely to be present include Australasian Bittern *Botaurus poiciloptilus*, Marsh Crake *Porzana pusilla affinis* and Spotless Crake *P. tabuensis plumbea*.
Limited sampling of freshwater fish has been undertaken. The slow-moving open water areas of the swamp contain large numbers of Inanga *Galaxias maculatus* and Short-finned Eels *Anguilla australis*. Less numerous species include Long-finned Eel *A. dieffenbachii* and Perch *Perca fluviatilis*. Long-finned Eel, Giant Kokopu *Galaxias argenteus*, Inanga and Common Bully *Gobiomorphus cotidianus* have been recorded in the natural outflow of Harman Swamp, Mirror Creek. Banded Kokopu *Galaxias fasciatus* has been recorded in tributaries of Mirror Creek. Given the brevity of the survey work carried out in the wetland, it is likely that some of the fish species found in the tributaries are also present in the open waters of the wetland.
Noteworthy flora: Two uncommon plants, *Coprosma "filifolia"* and *Olearia virgata* var. *laxiflora*, are found in Groves Swamp, and as many as four others may be present (*Myriophyllum robustum*, *Bulbinella modesta*, *Sparganium subglobosum* and *Epilobium gunnianum*). The range of plant communities and the high species richness of plants are a particular feature of the wetland.
Scientific research and facilities: None known.
Conservation education: The closeness of the wetland to Hokitika presents an excellent opportunity for school groups to visit the site and gain an understanding of the complex nature of wetlands.
Recreation and tourism: The predominant recreational use of the wetland is hunting. Other recreational use is limited.
Management authority: The Department of Conservation (West Coast Conservancy) is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.

Jurisdiction: Territorial: West Coast Regional Council and Westland District Council. Functional jurisdiction for conservation: Arahura Field Centre, Department of Conservation (West Coast Conservancy).
References: Eldon (1982); Department of Lands and Survey (1985); Overmars (1982).
Reasons for inclusion:

1b Groves Swamp and Harman Swamp are good representative examples of inland freshwater swamps in the West Coast region, a wetland type characteristic of New Zealand.

2a The swamps support populations of two threatened species of fish, *Galaxias argenteus* and *G. fasciatus*, and a threatened species of bird, *Botaurus poiciloptilus*.

2b The swamps support an unusually high diversity of plant species, and are thus of special value for maintaining the genetic and ecological diversity of the region. A total of 128 species have been recorded, including several uncommon species.

Source: John Lyall and Don Neale.

Shearer Swamp (49)

Location: 42°55'S, 170°45'E. 6 km southwest of Ross, Westland, South Island.
Area: c.135 ha.
Altitude: 5 m.
Overview: With the adjoining Ferguson's Bush Scenic Reserve, Shearer Swamp forms part of an increasingly rare example of a relatively intact succession from virgin lowland podocarp forest to unmodified inland swamp which eventually progresses into tidal lagoon. The swamp is typical of the West Coast "pakihi" swampland type. It supports a number of endemic threatened species including the Giant Kokopu *Galaxias argenteus* and Australasian Bittern *Botaurus poiciloptilus*. It also supports whitebait *Galaxias* spp. and other indigenous fish, as well as considerable numbers of waterfowl. Only the northern portion of the whole wetland area is included in this site account, the southern portion being extensively modified and of lesser conservation value.
Physical features: Shearer Swamp is a large (135 ha) coastal swampland, lying on a basement of prograded beach and alluvial sediment deposits. The wetland has low relief and slopes gently down from east to west, with a consequent raising of the water table towards the western edge. The swamp is bounded by coastal sand dunes to the northwest, forested hills slopes to the east, and approximately by Waikoriri Creek to the south. South of Waikoriri Creek, the water table is generally quite deep, possibly because of a very deep drainage ditch along the wetland's eastern boundary. North of the Waikoriri Creek, the hydrology gradually changes, with lower-lying areas remaining wetter. An abandoned logging tramway, dating from before 1970, runs along an embankment on old secondary sand dunes on the western edge of the wetland. This has formed a narrow border of deep channels of open, standing water on either side of the old track.
Ecological features: With the adjoining Ferguson's Bush Scenic Reserve, Shearer Swamp forms part of an increasingly rare example of a relatively intact succession from virgin lowland podocarp forest to unmodified inland swamp which eventually progresses into tidal lagoon. The swamp itself is of a type known as "pakihi", a feature of many West Coast wetlands. Pakihi is characterised by low fertility, poor drainage and an assemblage of indicator plant species. The portion of Shearer Swamp north of Waikoriri Creek is of greatest ecological value, and is the only portion of the swamp considered here. Most of the wetland habitat in the

southern portion of the swamp has been induced by logging and has been badly affected by land drainage for agricultural development.
The wetland north of the creek is advanced semi-fertile induced pakihi, becoming less fertile and more typical of pakihi towards the north. Common species in this portion of the wetland include New Zealand Flax *Phormium tenax*, *Gahnia rigida*, *Juncus* spp., *Coprosma* spp. and *Baumea* spp. Adjacent to the narrow strip of high ground running parallel with the old tramway on the western edge the swamp, the water table rises to the surface. Here there are some ponded areas and species such as Gorse *Ulex europaeus*, New Zealand Flax, *Coprosma* spp., *Baumea* spp. and *Eleocharis sphacelata*.
Land tenure: The wetland to the north of the creek is Crown land. The forested slopes to the east that comprise much of the swamp's catchment are Crown land, and form part of Ferguson's Bush Scenic Reserve, managed by the Department of Conservation. The majority of the strip of coastal foredune to the west is privately owned farmland and public road.
Conservation measures taken: The northern part of the swamp and other areas of Crown land have been gazetted either as Stewardship Area, Scenic Reserve or Wildlife Management Reserve. The Department of Conservation is responsible for the management of these areas.
Conservation measures proposed: It was intended by the previous management agency, the Department of Lands and Survey, that the swamp be given formal reserve status (probably as a Wildlife Management Reserve), but this did not happen. The area has been identified as worthy of higher protection status, but action on this awaits a review of protected area legislation.
Land use: The principal activities at the swamp are conservation of flora and fauna, protection of wildlife, waterfowl hunting, eeling and the harvesting of sphagnum moss. The southern portion of the wetland is used for cattle grazing and has been extensively drained. Sphagnum moss is currently being cropped throughout the eastern edge of this southern portion. Forested slopes to the east are within Ferguson's Bush Scenic Reserve, while the dunes to the west are grazed pasture. A public gravel road runs along these dunes parallel to the coast.
Possible changes in land use: None foreseen.
Disturbances and threats: The wetland portion to the south of the Waikoriri Creek has suffered considerably from the effects of grazing, drainage, burning and invasion by exotic colonisers such as Gorse *Ulex europaeus*. Waterfowl hunting and the harvesting of sphagnum moss may have some impact on the values of the wetland. There has been little disturbance to the northern part of the wetland, which has a reasonable buffering and is not subject to immediate threats.
Hydrological and biophysical values: The swamp helps to maintain water quality and assists in the recharge of water into the coastal lagoon and adjoining areas. It also plays an important role in supporting food chains.
Social and cultural values: The wetland supports a good population of whitebait *Galaxias* spp., and is therefore of importance to the small recreational whitebait fishery in the tidal areas downstream.
The area had a long history of logging, up until the late 1960s. A light wooden tramway, built in about 1903, was replaced in about 1922 with a heavy line which skirts the seaward margin of the swamp. The present road formation follows this tramway in parts. The swamp margins were logged in about 1900 for Silver Pine *Lagarostrobus colensoi*.
Noteworthy fauna: The swamp supports high numbers of Australasian Bittern *Botaurus poiciloptilus*, Marsh Crake *Porzana pusilla affinis* and South Island Fernbird *Bowdleria punctata punctata*. Other birds known to occur in the swamp include Black Shag *Phalacrocorax carbo*, Little Shag *P. melanoleucos*, Kotuku (Great Egret) *Egretta alba*, Paradise Shelduck *Tadorna variegata*, Mallard *Anas platyrhynchos*, Grey Duck *A.*

superciliosa, Australasian Harrier *Circus approximans*, Pukeko *Porphyrio porphyrio melanotus* and Spur-winged Plover *Vanellus miles*.
The swamp forms an excellent breeding area for native fish, including whitebait *Galaxias* spp., and also offers a large area of habitat for the adult galaxiids, especially Inanga *Galaxias maculatus* and Giant Kokopu *Galaxias argenteus*. Eels *Anguilla* spp. are present.
Noteworthy flora: None known. Little information is available on the flora of the swamp.
Scientific research and facilities: Nothing significant.
Conservation education: Nothing significant.
Recreation and tourism: The wetland is used by local people for waterfowl hunting (*Cygnus atratus* and *Anas* spp.).
Management authority: The Department of Conservation (West Coast Conservancy) is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources and the preparation of coastal plans.
Jurisdiction: Territorial: West Coast Regional Council and Westland District Council. Functional jurisdiction for conservation: Department of Conservation.
References: Department of Conservation (1986); Miller & Hutchinson (1986); Morse (1981).
Reasons for inclusion:

1a Shearer Swamp is a particularly good example of a West Coast "pakihi" wetland, a wetland type characteristic of New Zealand.

2a The wetland supports populations of two threatened species, the Australasian Bittern *Botaurus poiciloptilus* and Giant Kokopu *Galaxias argenteus*.

2b The wetland is of value in maintaining the ecological diversity of the region, as it is part of an intact sequence from virgin lowland podocarp forest through unmodified inland swamp to tidal lagoon.

Source: Don Neale and John Lyall.

Lake Ianthe (50)

Location: 43°03'S, 170°37'E. 11 km north-northeast of Harihari, South Westland, South Island. Entirely within the Lake Ianthe Scenic Reserve.
Area: c.550 ha.
Altitude: 30 m.
Overview: Lake Ianthe is a large body of open water mostly surrounded by hill slopes of indigenous podocarp forest, with a large flax swamp at its southern end. The wetland is an easily accessible and representative example of a West Coast lake, and supports a substantial diversity of wetland birds, including perhaps Westland's largest population of Great Crested Grebe *Podiceps cristatus australis*, an endangered species in New Zealand.
Physical features: The lake occupies the depression created by the lobe of a former glacial trough, and is surrounded on three sides by a moraine extending from the Wanganui River valley. The southern shores are bordered by swampy alluvial flats of recent geological origin. Drainage within the small 18.4 sq.km catchment is generally good, except for the swamp at the south. Two small creeks flow into the northern end of the lake, and the lake and swamp drain via Ianthe Creek into the Wanganui River. The lake has a maximum recorded depth of approximately 32 m towards the northern end, but more than half of the lake is less than six metres deep.

Ecological features: Lake Ianthe is a large body of open water mostly surrounded by indigenous podocarp/hardwood forest dominated by Rimu *Dacrydium cupressinum*, Rata *Metrosideros* sp. and Kamahi *Weinmannia racemosa*. Stands of Kahikatea *Dacrycarpus dacrydioides* interspersed with tall herbaceous swamp plants are found at the southern end of the lake. This large southern swamp, which covers over 100 ha, also contains New Zealand Flax *Phormium tenax*, Manuka *Leptospermum scoparium* and Cabbage Tree *Cordyline* sp., and is important habitat for waterfowl. Where the construction of roads and power lines has disturbed the native vegetation, scrub, introduced grasses and ferns are abundant.
Land tenure: The lake itself, part of the southern swamp, and the northern and eastern slopes of the catchment are Crown land within the Lake Ianthe Scenic Reserve. In the east, the reserve is bounded by a protection State Forest. State Highway 6 runs along the eastern lake shore. The southern margins of the swamp at the south end of the lake are within privately owned farmland. Indigenous production forest in an adjoining catchment to the north and west is owned by Timberlands Ltd., a state-owned enterprise.
Conservation measures taken: Lake Ianthe lies entirely within the Lake Ianthe Scenic Reserve, and is managed by the Department of Conservation. The northern and eastern slopes of the lake's catchment area are also within the Scenic Reserve. To the east, the reserve extends for about one kilometre, where it is bounded by a protection State Forest. Part of the southern swamp is also within the reserve, but its southern margins are excluded, and lie within privately owned farmland. Scenic Reserves are managed under the Reserves Act to protect their intrinsic natural and scenic values. A Management Plan for the reserve governs the management and use of the area. Recreational game-bird hunting is restricted to the western half of the lake.
Conservation measures proposed: None known.
Land use: The primary use of the lake and its surroundings is for the preservation and appreciation of its natural and scenic values. The area is also important for a range of recreational activities, including boating, fishing and waterfowl hunting. The reserve forms the final link in a chain of four Scenic Reserves bordering the State Highway northwards. The reserve is bounded by an indigenous production State Forest to the west and north (using selective logging and clear-felling techniques), by a protection State Forest to the east, and by private farmland to the south.
Possible changes in land use: None foreseen.
Disturbances and threats: Waterfowl hunting activities may have some impact on the ecological values of the lake.
Hydrological and biophysical values: The lake is thought to play a role in the natural storage of floodwaters flowing into the Wanganui River system.
Social and cultural values: The main social value of the wetland is in the recreational opportunities that it provides.
Noteworthy fauna: Lake Ianthe was identified as a "Site of Special Wildlife Interest" (SSWI) and assessed as "outstanding" by the Fauna Survey Unit of the New Zealand Wildlife Service. This is a nationwide wildlife habitat ranking system officially recognised by the Department of Conservation. The lake supports a significant population of waterfowl, principally at the southern end where it merges into swampland, and on the western side where luxuriant bush grows to the water's edge. An outstanding feature of the lake is that it supports perhaps the largest population of Great Crested Grebe *Podiceps cristatus australis* in Westland. Other waterbirds include Black Shag *Phalacrocorax carbo*, Black Swan *Cygnus atratus*, Grey Teal *Anas gracilis*, Mallard *A. platyrhynchos*, Grey Duck *A. superciliosa*, New Zealand Scaup *Aythya novaeseelandiae* and New Zealand Kingfisher *Halcyon sancta vagans*. The southern swamp is habitat for Australasian Bittern *Botaurus poiciloptilus*, crakes *Porzana* spp. and South Island Fernbird *Bowdleria punctata punctata*.

The lake contains large populations of eels *Anguilla* spp. and introduced Brown Trout *Salmo trutta*.

Noteworthy flora: The lakeshore vegetation is especially well developed, with many native water plants being abundant, *e.g. Limosella lineata*, *Isoetes* sp. and a stonewort, *Chara corallina*, which is not known elsewhere in New Zealand. The large tussocky sedge *Scirpus polystachyus* occurs on the lake shore. This species is found nowhere else in New Zealand, and possibly arrived by natural means from Australia. The swamp at the southern end of the lake is of considerable interest, but the associated kahikatea forest is not of outstanding quality.

Scientific research and facilities: Nothing significant.

Conservation education: The ease of access to the lake makes it suitable for conservation education, but no active programmes are presently in operation.

Recreation and tourism: Lake Ianthe is a popular rest stop and picnicking area for people travelling through South Westland. Toilet facilities, picnic tables, fireplaces, car parks and grassed areas have been established on the eastern shore of the lake. Informal camping also occurs in this area during the summer months. The other shores of the lake are relatively inaccessible. Boating, water-skiing and swimming are also popular, and a boat-launching ramp is located towards the southern end of the lake. Trout are plentiful in the lake, but can only be fished satisfactorily by boat. The lake is a popular area for waterfowl hunting.

Management authority: The Department of Conservation (West Coast Conservancy) is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources and the preparation of coastal plans. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.

Jurisdiction: Territorial: West Coast Regional Council, and Westland District Council. Functional jurisdiction for conservation: Department of Conservation.

References: Coker & Imboden (1980); Department of Conservation (1986); Department of Lands and Survey (1983b); Wardle (1980).

Reasons for inclusion:

1a Lake Ianthe is a particularly good representative example of a West Coast lacustrine habitat with a healthy freshwater swamp.

2a The swamp at the south end of the lake supports a population of *Botaurus poiciloptilus*, a globally threatened species.

2b The high quality swampland associated with the lake makes it of special value for maintaining the genetic and ecological diversity of the region.

2c The lake and associated swamp are important breeding habitat for a wide variety of waterfowl, and support possibly the largest population of *Podiceps cristatus* in Westland.

Source: Don Neale and John Lyall.

Whataroa Ecological Region Coastal Wetland Complex (51)

Location: 43°08'30"S, 170°15'E. Spread along some 40 km of coastline in the Whataroa Ecological Region, near Okarito village, West Coast, South Island. The wetland complex lies between the Wanganui River in the north and the Waiho River in the south.

Area: Not applicable.

Altitude: 0 m.

Overview: The complex of coastal wetlands including (from north to south) Saltwater Lagoon, the Whataroa River mouth, the Waitangitaona River mouth, Waitangiroto Lagoon and Swamp, Lake Windermere, Okarito Lagoon, Three Mile Lagoon and Five Mile Lagoon. Saltwater Lagoon, Waitangiroto Lagoon and Swamp, and Okarito Lagoon are of international significance in their own right, and are therefore described separately as Sites 51a, 51b & 51c below. The other wetlands are of lesser significance, but the overall integrity of the complex of wetlands deserves recognition.

The complex includes a wide range of coastal wetlands within a relatively small area. They lie largely within protected areas of Crown land, and support a wide range of habitats and species. At least 27 species of waterbirds occur in the area, as well as 12 indigenous species of fish and two exotic species of fish. The wetlands are of special significance as they support breeding populations of two species of waterfowl which are under threat in New Zealand, the Kotuku (Great Egret) *Egretta alba* and Royal Spoonbill *Platalea regia*. These birds are the basis of an important tourist venture in the area. Human impact on the natural values of these wetlands is generally quite low, while adjacent areas include good buffers of indigenous lowland podocarp forest that are ecologically important in their own right.

Physical features: The wetland complex is characterised by an extensive system of coastal wetlands, including slow-flowing stream mouths and coastal swamps (*e.g.* Waitangiroto and Five Mile), a coastal lake (Windermere), a braided gravel river bed (Whataroa) and large estuaries with tidal flats and saltmarsh (Saltwater, Okarito and Three Mile).

Ecological features: The area contains a diverse range of ecosystems. The rivers of South Westland flow through flat and often swampy country before they reach the coast. At their mouths, they generally form a lagoon and/or estuary with sand bars, and are frequently accompanied by brackish swamps and some forest. This mosaic of mudflats, open-water areas, sand bars and diverse plant communities provides valuable habitat for wildlife, particularly birds. The silty substrate of the estuarine areas contains a rich micro-fauna which forms the basis of a productive food chain. The small fish, shellfish, crustacea and other invertebrates which abound in these areas are readily accessible at low tide to shorebirds and other waterfowl. In the permanent, relatively shallow water of the lagoons, algae and other bottom vegetation are available as food for Black Swans *Cygnus atratus* and ducks *Anas* spp. The tall swamp vegetation around the edges of the lagoons provides nesting habitat for several species of Anatidae, particularly Black Swans. The sand bars separating the lagoons from the sea are important breeding and roosting areas for many seabirds and shorebirds. Many of the river mouth and lagoon habitats are partly surrounded by indigenous lowland podocarp forest dominated by Kahikatea *Dacrycarpus dacrydioides* and Rimu *Dacrydium cupressinum*. This forest acts as a buffer between the wetlands and farmland further inland, and provide nesting sites for shags *Phalacrocorax* spp. White-faced Heron *Egretta novaehollandiae* and some species of ducks. Many of the catchment areas remain relatively unmodified.

Typical tidal flat ecotypes are described in the site account for Okarito Lagoon (46c), and those for slow streams and coastal swamps are described in the site account for Waitangiroto Lagoon and Swamp (46b).

Land tenure: Most of the larger and more significant wetlands in the complex are Crown land and lie within protected areas managed by the Department of Conservation. Other wetlands are mostly in conservation stewardship managed by the Department of Conservation, with small areas of territorial authority and freehold land. Small areas of territorial authority and freehold land surround some wetland margins, particularly at the Whataroa and Waitangitaona Rivers.

Conservation measures taken: Most of the larger and more significant wetlands are included within four protected areas managed by the Department of Conservation. These are the Westland National Park, Okarito Wildlife Management Reserve, Waitangiroto Nature Reserve

and Saltwater Lagoon Scenic Reserve. Other wetlands are mostly in conservation stewardship. The wetland complex is within the South West New Zealand World Heritage Area.

Conservation measures proposed: See individual site accounts, especially that for Okarito Lagoon (46c).

Land use: The primary use of many of the wetlands and adjacent areas is for the protection of their natural values. Some wetland margins, such as the Whataroa River bed and parts of Okarito Lagoon, are developed farmland used for grazing cattle and sheep. Further details are given in the individual site accounts.

Possible changes in land use: See individual site accounts, especially that for Okarito Lagoon (46c).

Disturbances and threats: See individual site accounts.

Hydrological and biophysical values: All of the wetlands are important biophysical transitions from sea to freshwater and land for many species and biological communities.

Social and cultural values: See individual site accounts, particularly those for Saltwater Lagoon (46a) and Okarito Lagoon (46c).

Noteworthy fauna: The wetland complex is used by at least 27 species of waterbirds including shags *Phalacrocorax* spp., Australasian Bittern *Botaurus poiciloptilus*, White-faced Heron *Egretta novaehollandiae*, Kotuku (Great Egret) *E. alba*, Royal Spoonbill *Platalea regia*, Paradise Shelduck *Tadorna variegata*, New Zealand Shoveler *Anas rhynchotis variegata*, New Zealand Scaup *Aythya novaeseelandiae*, South Island Pied Oystercatcher *Haematopus finschi*, Variable Oystercatcher *H. unicolor*, Banded Dotterel *Charadrius bicinctus*, Black-billed Gull *Larus bulleri*, Caspian Tern *Sterna caspia* and South Island Fernbird *Bowdleria punctata punctata*. Many of these species breed in the immediate vicinity of the wetlands. The extent and diversity of the system as feeding, roosting and breeding areas are probably important factors in the breeding success of the Kotuku *E. alba* and Royal Spoonbill *P. regia* at the Waitangiroto Reserve. This is the only known breeding site in New Zealand for the Kotuku (up to 140-150 birds), and one of only four breeding sites in New Zealand for the Royal Spoonbill (up to 16 pairs, or over 25% of the national population). The wetlands also constitute important habitat for at least 12 indigenous and two exotic species of fish, many of which are diadromous, *e.g. Galaxias* spp. and *Anguilla* spp. Other species, such as the flounder, are mostly resident in the estuary.

Noteworthy flora: There is a lack of information on noteworthy plant species, but the overall quality and diversity of the aquatic and terrestrial plant communities make it a very important wetland complex. Marginal saltmarsh vegetation is a particularly vulnerable habitat type that is abundant in the area.

Scientific research and facilities: See individual site accounts.

Conservation education: See individual site accounts.

Recreon: Department of Conservation, Haast Field Centre.

References: Department of Conservation (1986); Johnson & Lee (1977); Johnson *et al.* (1979).

Reasons for inclusion:

1a Hermitage Swamp is a good representative example a freshwater swamp and bog complex, a wetland characteristic of the Haast region of the West Coast of New Zealand.

2b The swamp supports a number of indigenous species of fish, and is thus of special value for maintaining the genetic and ecological diversity of the region

2c The swamp is of special value as a nursery area for whitebait *Galaxias* spp.

Source: Chris Woolmore, John Lyall and Don Neale.

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Saltwater Lagoon (51a)

Location: 43°06'S, 170°21'E. 16 km west-northwest of Harihari, South Westland, South Island. Within the Saltwater Lagoon Scenic Reserve and bounded by the Saltwater State Forest, with the Tasman Sea to the northwest.
Area: c.850 ha.
Altitude: 0 m.
Overview: A shallow tidal estuary, occasionally blocked from the sea, which is enclosed on the seaward side by a narrow barrier beach dune system and surrounded on the other sides by lowland podocarp forest. Freshwater swamps around its margin add to the diversity of habitats that make the lagoon of importance to waterfowl. Saltwater Lagoon is an important part of a complex of high quality wetland habitats extending along some 40 km of coastline from the Waiho River in the south to the Wanganui River in the north.
Physical features: Saltwater Lagoon is a moderately large but shallow tidal estuary, about 5 km long and 2 km wide. It has an outlet at the southern end that is occasionally blocked by a build-up of the enclosing barrier beach. As a result, it occasionally changes from a brackish tidal estuary to a mostly freshwater coastal lagoon. Lying in an outwash depression beneath Pleistocene moraines, the lagoon has a very small catchment area and is not fed by any major streams. A narrow moraine ridge (Mermaid Peninsula) extends for some 1.5 km across the lagoon's tidal flats.
Ecological features: The lagoon is a valuable example of a coastal estuarine wetland with diverse habitat features. Much of the lagoon consists of bare or sparsely vegetated tidal mudflats, but the upper tidal margins support reedbeds dominated by *Typha orientalis*, *Leptocarpus* spp. and *Eleocharis sphacelata*. The narrow swampy margins of the lagoon are dominated by *Carex virgata*, *Phormium tenax* and *Leptocarpus similis* (endemic), with *Leptospermum sp*. further back. Remnants of indigenous dune vegetation are botanically important, but are modified by past and present grazing and burning.
The surrounding lowland podocarp forest is dominated by Kahikatea *Dacrycarpus dacrydioides* and Rimu *Dacrydium cupressinum.*
Land tenure: The wetland is Crown land held as Scenic Reserve. Most of the catchment of the lagoon is within Saltwater State Forest, managed by Timberlands Ltd., a state-owned enterprise.
Conservation measures taken: The wetland has been designated as a Scenic Reserve and is managed by the Department of Conservation. Saltwater Lagoon is unusual in New Zealand in being one of very few (and also one of the largest) tidally influenced bodies of water with Scenic Reserve status. Scenic Reserve designation gives the area a high level of protection for landscape, ecological and conservation purposes. A narrow strip of land surrounding the whole lagoon (including the barrier beach dunes) and a portion of land to the northwest are also within the Scenic Reserve. The Saltwater Lagoon Scenic Reserve Management Plan directs the management of the reserve, including the lagoon. The lagoon is within the South West New Zealand World Heritage Area. Some fencing of the dune area has been carried out in the past to assess the impact of domestic livestock. The southern portion of the dunes was fenced to act as a control site, but this experiment met with limited success due to continued access by livestock into this portion from the beach and mudflats.
Conservation measures proposed: None known.
Land use: Being remote and at some distance from the nearest road access, the lagoon attracts little public attention. Most use stems from people fishing for whitebait or duck shooting. Most use in the surrounding areas stems from possum-hunters and deer-hunters. The barrier beach area is increasingly being used by local trail-bike owners, and a grazing lease covers the central portion of the barrier beach. Further from the wetland, much of the

Scenic Reserve is surrounded by the Saltwater State Forest, which is to be logged on a sustained yield basis. The lagoon's catchment is currently unlogged.

Possible changes in land use: None foreseen.

Disturbances and threats: The use of trail-bikes conflicts with the purposes of the Scenic Reserve, but is difficult to control. Grazing, burning and exotic plants such as gorse and pasture grasses have modified the natural character of the barrier beach dunes. Vegetation monitoring is being carried out to determine whether or not the continuation of grazing benefits some of the indigenous flora by controlling the growth of gorse.

Hydrological and biophysical values: The lagoon is seen to be a good example of the change from a brackish tidal estuary to a coastal freshwater lake, due to the progressive build-up of the barrier beach and blocking of the mouth. The hydrology of the estuarine system is fundamental to its ecology and fisheries values. The wetland is important in supporting aquatic and terrestrial food chains.

Social and cultural values: Mostly outdoor recreation; tramping, hunting and fishing. There are numerous sites associated with nineteenth and early twentieth century gold-mining within and adjacent to the lagoon. h Maori settlement was recorded at the mouth of the lagoon in the early nineteenth century. At this site, a large meeting of Maori negotiated the West Coast purchase with James Mackay in June 1860.

Noteworthy fauna: Saltwater Lagoon was assessed as an "outstanding" "Site of Special Wildlife Interest" (SSWI) by the Fauna Survey Unit of the New Zealand Wildlife Service. This is a nationwide wildlife habitat ranking system officially recognised by the Department of Conservation. Imboden and Coker (1978) found that the lagoon supports some 25 species of waterfowl including Great Crested Grebe *Podiceps cristatus australis*, Black Shag *Phalacrocorax carbo,* Little Shag *P. melanoleucos*, Australasian Bittern *Botaurus poiciloptilus*, White-faced Heron Egretta *novaehollandiae*, Little Egret *E. garzetta*, Great Egret or White Heron *E. alba*, Royal Spoonbill *Platalea regia*, Black Swan *Cygnus atratus*, Paradise Shelduck *Tadorna variegata*, Mallard *Anas platyrhynchos*, Grey Duck *A. superciliosa*, New Zealand Shoveler *A. rhynchotis variegata*, New Zealand Scaup *Aythya novaeseelandiae*, Pukeko *Porphyrio porphyrio melanotus*, South Island Pied Oystercatcher *Haematopus finschi*, Variable Oystercatcher *H. unicolor*, Pied Stilt *Himantopus leucocephalus*, Banded Dotterel *Charadrius bicinctus*, Spur-winged Plover *Vanellus miles*, Bartailed Godwit *Limosa lapponica*, Red-billed Gull *Larus scopulinus*, Black-billed Gull *L. bulleri*, Caspian Tern *Sterna caspia* and White-fronted Tern *S. striata.* Other birds associated with the wetlands include Australasian Harrier *Circus approximans*, Welcome Swallow *Hirundo tahitica* and South Island Fernbird *Bowdleria punctata punctata*.

The gently sloping shores of the lagoon provide good habitat for dabbling ducks, whilst its depth and expanse of clean waters suit species such as the New Zealand Scaup, a diving duck. Marginal reed-beds and swamp vegetation make it especially valuable for breeding and moulting birds. Great Egrets (Kotuku) frequent the lagoon on feeding excursions from the nearby breeding colony at Waitangiroto. There is an unconfirmed report of Brown Teal *Anas aucklandica* dating from the 1950s.

No fish surveys are known to have been carried out in the lagoon, but Davis (1987) rated the lagoon as being of national importance to fisheries, probably on the basis of its natural state. The wetland is likely to be an important feeding and breeding area for fish.

Noteworthy flora: There is a lack of information on noteworthy plant species, but the overall quality and diversity of the aquatic and terrestrial plant communities at Saltwater Lagoon make it a very important wetland. Scientific research and facilities: Some scientific work, mostly botanical and archaeological studies, has been carried out in the Scenic Reserve and at the lagoon. No research facilities are present.

Conservation education: Nothing significant.
Recreation and tourism: Recreational activities are severely limited by the remoteness of the area and difficulty of access. The main recreational uses are hunting (deer, duck and possum), fishing for whitebait and surf-casting.
Management authority: The Department of Conservation (West Coast Conservancy) is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources and the preparation of coastal plans. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and gamebird hunting.
Jurisdiction: Territorial: West Coast Regional Council and Westland District Council. Functional jurisdiction for conservation: Department of Conservation.
References: Coker & Imboden (1980); Davis (1987); Department of Conservation
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(1986); Department of Lands & Survey (1984); Hooker (1986); Imboden & Coker (1978); Johnson (1989); Neale (1990); Wardle (1980).
Reasons for inclusion:

1a Saltwater Lagoon is a particularly good example of one step in the sequential geomorphic progression from a tidal estuary to a coastal lake. This is a phenomenon occurring (at different stages) in similar water bodies throughout the West Coast region. The lagoon is an important part of a complex of high quality wetland habitats extending along some 40 km of coastline from the Waiho River in the south to the Wanganui River in the north.

2a The lagoon supports a population of a globally threatened species of bird, *Botaurus poiciloptilus.*

2b The wetland contains a wide diversity of wetland habitats and supports a large number of species of waterbirds including several that are scarce or local elsewhere in New Zealand (e.g. *Egretta alba* and *Platalea regia*); it is thus of considerable importance in maintaining the genetic and ecological diversity of the region.

2c The lagoon is especially important as breeding habitat for a number of species of waterfowl.

2d The lagoon is of special value for its endemic bird species, including *Tadorna variegata, Aythya novaeseelandiae, Haematopus finschi, H. unicolor, Larus bulleri* and *Bowdleria punctata.*

Source: Don Neale, Ray Hooker and John Lyll.

Waitangiroto Lagoon and Swamp (51b)

Location: 43°08'30"S, 170°15'E. 14 km northwest of Whataroa, South Westland, South Island.
Area: c.680 ha.
Altitude: 15 m.
Overview: The Waitangiroto is an indigenous forested coastal swampland with a tidal lagoon and slow meandering stream flowing through it. It lies entirely within the Waitangiroto Nature Reserve, and is important for its high ecological values, including the only known breeding colony of Kotuku (Great Egret or White Heron) *Egretta alba* in New Zealand and a large remnant Kahikatea forest. The wetland is an important part of a

complex of high quality wetland habitats extending along some 40 km of coastline from the Waiho River in the south to the Wanganui River in the north.

Physical features: The Waitangiroto River is a slow-flowing stream that meanders for some 13 km across an alluvial silt terrace between a Pleistocene moraine in the south and the Waitangitaona River in the north. Depending on its outlet to the sea, the Waitangiroto is tidal as far as 4 km upstream of its mouth. For its size, the Waitangiroto is an unusually deep and steep-sided stream, features attributed to a near absence of bedload and the fact that it carries large volumes of Waitangitaona floodwaters in rare events. The Waitangiroto catchment totals 21 sq.km, and is within the larger valley system of the Whataroa River.

The mouths of the Waitangiroto and Waitangitaona Rivers usually combine to form a narrow coastal lagoon on a broad gravel beach surface. The mouth occasionally closes during low flow levels, and if prolonged, this can damage streambank vegetation. At other times, direct wave action from the sea can cause substantial slumping of the easily eroded lagoon banks.

Ecological features: The Waitangiroto is a coastal podocarp swampland dominated by Kahikatea *Dacrycarpus dacrydioides* and *Rimu Dacrydium cupressinum*, among low stature hardwood forest (including Kowhai *Sophora microphylla* and Mahoe *Melicytus ramiflorus*, stunted somewhat by salt shear. Riparian areas affected by flooding support fertile swamp and patches of seral scrub and young forest.

Land tenure: The whole of the wetland is Crown land within the Waitangiroto Nature Reserve, managed by the Department of Conservation. Surrounding areas are Crown land held as Nature Reserve and Wildlife Management

Reserve, and Okarito State Forest managed by Timberlands, a state-owned enterprise. Land to the north and east is Crown land and leasehold land of the Whataroa River flats.

Conservation measures taken: The whole of the wetland is within the Waitangiroto Nature Reserve, managed by the Department of Conservation. The primary purpose of the Nature Reserve is to protect the breeding colony of Kotuku *Egretta alba* and Royal Spoonbill *Platalea regia*, as well as the associated alluvial flats, swamps and moraine ridges of the Waitangiroto River. The purpose of Nature Reserves is to protect and preserve "in perpetuity indigenous flora or fauna or natural features that are of such rarity, scientific interest or importance, or so unique that their protection and preservation are in the public interest."

Access to the Nature Reserve is allowed by permit only. Aircraft access is prohibited below 2,000 ft altitude from August to February each year, to minimise disturbance to the kotuku and spoonbill breeding colony during the time these birds are present. The reserve has a resident caretaker during the breeding season (September to January). The Nature Reserve includes parts of the land surrounding the wetland, including the lower 6 km of the Waitangiroto River. The lagoon is within the South West New Zealand World Heritage Area.

Conservation measures proposed: None foreseen.

Land use: Land use is restricted by the difficult access to the area. The wetland is used primarily for the protection of the Kotuku and Royal Spoonbill breeding site. A commercial concession license is operating for the guiding of visitors to the wetland by jet-boat and boarded walkway during the breeding season. The reserve includes a good buffer for the wetland. Outside the reserve, land to the north and east (including part of the wetland's catchment area) is used for low levels of stock grazing.

Possible changes in land use: None foreseen.

Disturbances and threats: The birds nesting at the heron colony are very vulnerable to disturbance, hence the high level of control over the area. Few significant human threats are

known to exist, since access is controlled by permit. However, illegal entry by people in aircraft, boats or on foot does occur, and may cause some disturbance. The tourism concession license is carefully controlled during the breeding season by a resident reserve caretaker, and by the use of an observation hide and boarded walkway. Jetboats are restricted to the lower reaches of the wetland, away from the heron colony, and to low travelling speeds.

The coastline has naturally eroded several hundred metres in the past 30 years. Morrissey (1974) suggested that by destroying the coastal forest, this erosion might progressively expose the heron colony to westerly winds and alter the tidal hydrology at the colony. High water levels in the wetland can threaten the natural stability of this low energy wetland. The dynamic character and low relief of the Whataroa River valley in which the wetland lies combine to create a potential for catastrophic change in the river courses and overall hydrology of the area. Beck (1980) showed that flood peaks in the Waitangiroto River could be expected to rise by 40% if the upper catchment swamp was converted to pasture, although such an action is not presently envisaged. Natural blockage of the lagoon mouth and exposure to wave action at other times have caused much damage to the lower reaches. In parts of the forest, browsing by deer and possums inhibits regeneration of palatable hardwoods, including Kowhai.

Hydrological and biophysical values: The hydrological stability and low energy nature of the wetland is of fundamental importance to the welfare of the Kotuku and spoonbill breeding colony, as well as to the general wetland ecology of the area.

Social and cultural values: The wetland and heron colony have in recent years become a major tourist attraction, and this helps to generate significant income for the Whataroa community. The Kotuku is a sacred bird to the Maori people. It is the "bird of last flight", carrying away the spirit of the deceased. A Maori settlement was recorded by European explorers between the mouth of the Waitangiroto and Waitangitoana.

Noteworthy fauna: The most important feature of the wetland is the breeding colony of Kotuku (Great Egret or White Heron) *Egretta alba* and Royal Spoonbill *Platalea regia*. Waitangiroto is the only known breeding site for Kotuku in NewZealand, and one of only four known breeding sites for Royal Spoonbill. Up to 140-150 Kotuku and up to 16 pairs of Royal Spoonbill (over 25% of the national population) are present at the colony, with breeding taking place between September and January. Up to 40 Little Shag *Phalacrocorax melanoleucos* share the same colony site.

There is little information on the fishery values of the wetland.

Noteworthy flora: The wetland is notable for a complex of natural swamp and floodplain communities, with the outstanding feature being a sizeable stand (the best example in New Zealand) of mature Kahikatea *Dacrycarpus dacrydioides* forest.

Scientific research and facilities: No particular scientific research programme occurs at the wetland, although work has been carried out on the ecological features of the reserve. A Department of Conservation hut in the reserve provides accommodation.

Conservation education: There is considerable use of the area for "ecotourism", with associated education. The tourism concession currently operating includes a guided interpretation of the wetland and the birdlife associated with it.

Recreation and tourism: A commercial tourist operation carries up to 2,000 people per year to the kotuku and spoonbill colony during the breeding season. This includes a jet-boat ride into the lower reaches of the Waitangiroto River, and a boardwalk through swamp forest to an observation hide at the colony.

Management authority: The Department of Conservation (West Coast Conservancy) is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water

resources and the preparation of coastal plans. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and gamebird hunting.
Jurisdiction: Territorial: West Coast Regional Council and Westland District Council. Functional jurisdiction for conservation: Department of Conservation.
References: Beck (1980); Department of Conservation (1986); Department of Lands and Survey (1989); Morrissey (1974); Neale (1990); Wardle (1980).
Reasons for inclusion:

1a/d Waitangiroto Lagoon is a particularly good example of a coastal lagoonal wetland and swamp forest in the West Coast region of New Zealand. It includes the largest remnant of kahikatea swamp, an endemic habitat which is now rare. The lagoon is an important part of a complex of high quality wetland habitats extending along some 40 km of coastline from the Waiho River in the south to the Wanganui River in the north.

2b The lagoon supports the only breeding colony of *Egretta alba* in New Zealand, and one of only four breeding colonies of *Platalea regia*; it is thus of importance in maintaining the genetic and ecological diversity of the region.

2c The lagoon supports important breeding populations of *Egretta alba*, *Platalea regia* and other waterfowl.

Source: Don Neale, Ray Hooker and John Lyall.

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Okarito Lagoon (51c)

Location: 43°11'S, 170°13'E. 15 km northwest of Whataroa, South Westland, South Island. Bounded to the west by the Tasman Sea and to the east by North Okarito forest.
Area: c.3,240 ha.
Altitude: 0 m.
Overview: A large shallow estuary exhibiting a transition from sea to freshwater and land, with inter-tidal mudflats, saltmarshes, low islands and swamps protected by a broad barrier beach. The estuary is important for its high ecological, recreational and human values. The wetland is an important part of a complex of high quality wetland habitats extending along some 40 km of coastline from the Waiho River in the south to the Wanganui River in the north.
Physical features: Okarito Lagoon is a large estuary, about 10 km long and 3 km wide; it is relatively shallow (1-5 m), and has extensive mudflats, sandflats, saltmarshes and freshwater swamps. Lying in an outwash depression between Pleistocene moraines, the estuary is fed primarily by the Okarito River and connects with the sea at the southern end of the broad barrier beach that encloses it.
The tidal range varies from 0.8 m at the mouth to 0.17 m in the upper estuary, and floods can raise the water level by 2-3 m. The estuary is floored with organic-rich mud and sandy mud, deposited from suspension. The three main catchments of the estuary (total area 27,000 ha) are mostly forested, including lowland till and outwash surfaces, and mountainous slopes of the Southern Alps.
Ecological features: The estuary is a valuable example of the transition from saltwater to a freshwater wetland, with a mixture of sandy and silty substrates and a wide range of habitats. The mudflats are rich in weed (e.g. *Zostera* sp., *Enteromorpha* sp. and *Nitella* sp.), benthic invertebrates (e.g. *Austrovenus stutchburyi*, *Amphibola crenata* and *Hemigrapsus crenulatus*) and marginal saltmarsh and swamp vegetation (e.g. Jointed Wire Rush

Leptocarpus similis and New Zealand Flax *Phormium tenax*), which provide food and habitat for many different species of wildlife.

The estuary margins are well buffered by indigenous lowland podocarp forest dominated by Kahikatea *Dacrycarpus* dacrydioides and Rimu *Dacrydium cupressinum*. Large portions of the catchment areas remain relatively unmodified, but North Okarito Forest, behind the eastern buffer of the estuary, is managed by Timberlands Ltd. for production forestry purposes.

Land tenure: Below mean high water mark, the estuary bed is Crown land managed by the Department of Conservation. Most of the land within the wetland (islands and barrier beach) is also Crown land managed by the Department of Conservation.

To the north, the wetland is bounded by the Waitangiroto Nature Reserve (Crown land managed by the Department of Conservation for protection purposes). To the east, most of the surrounding land behind a buffer strip of several hundred metres of high forest is indigenous production forest managed by Timberlands Ltd., a state-owned enterprise, except for the beds and banks of the two main rivers (Okarito and Okutua) that flow into the estuary. A portion of indigenous forest to the east of the estuary, currently managed by the Department of Conservation, is soon to be transferred to Timberlands Ltd. for production forestry purposes. Much of the small Okarito settlement in the south of the area is in private ownership. Legal road, managed by the Westland District Council, borders the estuary on the approach to the township.

Conservation measures taken: The estuary bed below the mean high water mark is Crown land managed by the Department of Conservation. Crown land within the wetland (islands and barrier beach) has been designated as a Wildlife Management Reserve and is managed by the Department of Conservation. The wetland is bounded to the north by the Waitangiroto Nature Reserve. The estuary is within the South West New Zealand World Heritage Area.

Conservation measures proposed: The New Zealand Wildlife Service and the Royal Forest and Bird Protection Society of New Zealand suggested Okarito Lagoon as a wetland suitable for listing under the Ramsar Convention, but a case has not been prepared. It is intended to include the bed of Okarito Lagoon in the existing Wildlife Management Reserve in the near future.

Land use: Grazing of domestic livestock occurs on the margins of the wetland and on nearby pastures. Waterfowl hunting (ducks and swans) is a popular recreational use of the estuary. Production forestry is the predominant use of the indigenous forest to the east of the estuary, with deer hunting is also popular here. The Okarito settlement in the south has a resident population of about 15, and tourism is seasonally important in the settlement and adjacent areas, primarily due to the varied, scenic and unpopulated features of the area.

Possible changes in land use: The leasing arrangements for grazing on the main island in the estuary are currently being reviewed. Extension of the Lake Wahapo Power Scheme into the estuary's catchment may alter the hydrology of the estuary. A portion of indigenous forest to the east of the estuary, currently managed by the Department of Conservation, is soon to be transferred to Timberlands Ltd. for production forestry purposes.

Disturbances and threats: Sheep and cattle are grazed on land in and adjoining the wetland, and this keeps extensive areas in exotic grasses and gorse. A study by MacPherson (1981) assessed the impact of logging in North Okarito Forest on the sedimentation of the Okarito Lagoon. It was found that the lagoon environment is normally highly variable and is dominated by the input of sediment from the relatively undisturbed Okarito River catchment. The selective logging that occurs in the catchments of the smaller streams draining North Okarito Forest has been found not to have a significant influence the lagoon's ecosystem.

Hydrological and biophysical values: MacPherson (1981) made an extensive study of the hydrology of the estuary. Okarito Lagoon is an important biophysical transition from sea to freshwater and land for many species and biological communities. The lagoon is of great importance in supporting aquatic and terrestrial food chains.

Social and cultural values: A small settlement at the southern end of the estuary is a popular tourist attraction. The estuary is important as a recreational and subsistence fishing and waterfowl hunting area. European settlers Brunner and Sherrin recorded that the lagoon and environs were renowned as a Maori eeling and bird hunting resource. They also reported the remains of a substantial village near Okarito. Archaeological and historic sites are located at Okarito settlement and along consolidated dunes west of the lagoon. Sites include shell middens, a rock shelter and gold-mining remains. Black sand gold-mining has been undertaken continuously since 1866 along the western margin of the lagoon. A pioneer cemetery is located on the sandspit.

Noteworthy fauna: Okarito Lagoon was assessed as an "outstanding" "Site of Special Wildlife Interest" (SSWI) by the Fauna Survey Unit of the New Zealand Wildlife Service. This is a nationwide wildlife habitat ranking system officially recognised by the Department of Conservation. The estuary is used by at least 27 species of waterfowl. Breeding species include Black Shag *Phalacrocorax carbo*, Little Shag *P. melanoleucos*, Australasian Bittern *Botaurus poiciloptilus*, White-faced Heron *Egretta novaehollandiae*, Black Swan *Cygnus atratus*, Mallard *Anas platyrhynchos*, Grey Duck *A. superciliosa*, New Zealand Shoveler *A. rhynchotis variegata*, New Zealand Scaup *Aythya novaeseelandiae*, Pukeko *Porphyrio porphyrio melanotus*, South Island Pied Oystercatcher *Haematopus finschi*, Variable Oystercatcher *H. unicolor*, Pied Stilt *Himantopus leucocephalus*, Banded Dotterel *Charadrius bicinctus*, Spurwinged Plover *Vanellus miles*, Red-billed Gull *Larus scopulinus*, Black-billed Gull *L. bulleri*, Caspian Tern *Sterna caspia* and White-fronted Tern *S. striata*. Kotuku (Great Egret) *Egretta alba* and Royal Spoonbill *Platalea regia* from the nearby breeding colony at Waitangiroto (Site 51b) regularly feed in the estuary; the proximity of the rich feeding areas in the estuary to the breeding site is probably an important factor in the success of this colony. Other non-breeding visitors to the estuary include Little Egret *Egretta garzetta*, Paradise Shelduck *Tadorna variegata* and Bar-tailed Godwit *Limosa lapponica*. Other birds associated with the wetlands include Australasian Harrier *Circus approximans*, Welcome Swallow *Hirundo tahitica* and South Island Fernbird *Bowdleria punctata punctata.*

The estuary is important habitat for at least 12 indigenous and two exotic species of fish, many of which are diadromous (e.g. *Galaxias* spp. and *Anguilla* spp.). Other species, such as flounder, are mostly resident in the estuary.

Noteworthy flora: There is a lack of information on noteworthy plant species, but the overall quality and diversity of the aquatic and terrestrial plant communities at Okarito Lagoon make it a very important wetland. Marginal saltmarsh vegetation is a particularly vulnerable habitat type that is abundant at Okarito Lagoon.

Scientific research and facilities: Knox et al. (1976) have made the most extensive ecological survey of the estuary to date. No current research of note is being undertaken at the wetland, and no special research facilities exist there.

Conservation education: Okarito Lagoon is often visited by the Department of Conservation's Summer Visitor Programme, offering wide scope for environmental interpretation. Some cottages in the nearby settlement are owned and used bynational conservation organisations.

Recreation and tourism: Okarito Lagoon is an important area for outdoor recreation, popular activities including sight-seeing, boating, waterfowl hunting, fishing and walking.

Okarito settlement is a small but well known tourist attraction, due primarily to its isolated and scenic nature.

Management authority: The Department of Conservation (West Coast Conservancy) is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources and the preparation of coastal plans. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and gamebird hunting.

Jurisdiction: Territorial: West Coast Regional Council and Westland District Council. Functional jurisdiction for conservation: Department of Conservation.

References: Anon. (1976, 198?); Coker & Imboden (1980); Davis (1987); Department of Conservation (1986); Hooker (1986); Johnson (1989); Knox et al. (1976); MacPherson (1981); Neale (1990).

Reasons for inclusion:

1a/d Okarito Lagoon is a particularly good example (and the largest example) of a bar-built estuarine mudflat-saltmarsh wetland in the West Coast region; such communities are nationally uncommon and vulnerable. It is an important part of a complex of high quality wetland habitats extending along some 40 km of coastline from the Waiho River in the south to the Wanganui River in the north.

2a The estuary supports a population of a globally threatened species of bird, *Botaurus poiciloptilus*.

2b The estuary contains a wide diversity of wetland habitats and supports a large number of species of waterbirds including several that are scarce or local elsewhere in New Zealand (e.g. *Egretta alba* and Platalea regia); it is thus of considerable importance in maintaining the genetic and ecological diversity of the region.

2c The estuary is especially important as breeding habitat for a large number of species of waterfowl.

2d The estuary is of special value for its endemic bird species, including *Tadorna variegata, Aythya novaeseelandiae, Haematopus finschi, H. unicolor, Larus bulleri* and *Bowdleria punctata*.

Source: Don Neale, Ray Hooker and John Lyall.

Ohinetamatea Swamp (52)

Location: 43°30'S, 169°50'E. 16 km southwest of Fox Glacier township, South Westland, West Coast, South Island.

Area: c.1,500 ha.

Altitude: 25 m.

Overview: Ohinetamatea Swamp is a high fertility system that receives sediment input from the Ohinetamatea River. There is a range of vegetation associations in the wetland that are characteristic of inland freshwater swamps of the West Coast region. This range, combined with the low degree of external impacts by humans over most of the area of the wetland, is reflected in the high diversity of ecological values attached to the wetland. The swamp supports a number of threatened species of fish, birds and bat.

Physical features: Two lateral moraines and a terrace, formed by the Otira glaciation some 14,000 years ago, dominate the immediate landscape around the wetland. Fluvial action of the Ohinetamatea River within the confines of the moraines has resulted in the creation of

the wetland. The river meanders within the floodplain, taking 19 km to fall the 25 m to sea level. Naturally formed levees impede drainage of the wetland into the Ohinetamatea River.

Ecological features: Ohinetamatea is an extensive New Zealand Flax *Phormium tenax* swamp with large areas of *Carex* spp. and *Scirpus* spp., some Raupo *Typha orientalis* and fringing stands of Kahikatea *Dacrycarpus dacrydiodes*.

Four major community classes dominate the wetland:

- podocarp swamp, comprising Kahikatea *Dacrycarpus dacrydiodes*, Bog Pine *Dacrydium bidwillii* and Mountain Toatoa *Phyllocladus alpinus*;
- shrub swamp, comprising Manuka *Leptospermum scoparium* and *Coprosma* spp . ;
- flax swamp, comprising New Zealand Flax *Phormium tenax* and Pukio *Carex secta*;
- rush and sedge swamp, comprising Wire Brush *Empodisma minus*, *Carex* spp. and *Baumea* spp.

Land tenure: Two private land-owners have freehold land titles over the wetland on the true left bank of the Ohinetamatea River. These titles encompass the larger portion of the wetland. The remaining area of wetland on the true right bank is Crown land managed by the Department of Conservation. Adjacent land on the left bank of the river through to the foothills is privately owned farmland; that on the right bank is Crown land managed by the Department of Conservation.

Conservation measures taken: That part of the wetland that is Crown land is managed by the Department of Conservation under the Conservation Act (1987) as Stewardship Area. The wetland is within the South West New Zealand World Heritage Area.

Conservation measures proposed: An investigation is under way concerning the possible addition of the conservation area (Stewardship Area) to the Westland National Park (National Parks Act 1980). The Department of Conservation has provided advice to land owners on the intrinsic values of the wetland and has also provided advice on water right applications to the West Coast Regional Council (the consenting agent for water rights to allow drainage, river protection works etc.).

Land use: Primary uses of the wetland are for conservation purposes, livestock grazing and the harvesting of sphagnum moss. Primary uses of the nearby areas are for conservation purposes in the upper and lower reaches of the Ohinetamatea River and cattle grazing in the middle reaches.

Possible changes in land use: Further drainage and farm development is likely on freehold titles. No major changes are foreseen within the catchment area. Disturbances and threats: Invasion of willow *Salix* sp. and other exotic weed species affects the botanical composition of the wetland. Sphagnum moss is being harvested on the freehold sections of the wetland. There are grazing and trampling impacts associated with the present grazing regime. The wetland helps to support a commercial eel fishery in the area. Generally these impacts are believed to be of a minor nature. Further conversion of the wetland into developed pasture by burning, land clearance and drainage would substantially alter the wetland.

Hydrological and biophysical values: The hydrology of the area is fundamental to the ecological functioning of the wetland. The wetland plays a general role in flood control and sediment trapping, and is of great importance in supporting aquatic and terrestrial food chains. It is particularly important in the maintenance of the indigenous fishery.

Social and cultural values: Whitebaiting (fishing for juvenile *Galaxias* spp. during their spring migration) occurs in the lower tidal reaches of the Ohinetamatea River which is fed by the swamp, and is an important social, cultural, recreational and economic activity in South Westland. The southern part of the wetland is used for cattle farming.

Noteworthy fauna: Ohinetamatea Swamp was identified as a "Site of Special Wildlife Interest" (SSWI) by the Fauna Survey Unit of the New Zealand wildlife Service, and assessed as being of "high" value. This is a nationwide wildlife habitat ranking system officially recognised by the Department of Conservation. The area is noted for its wide variety of wetland birds, including Australasian Bittern *Botaurus poiciloptilus*, Marsh Crake *Porzana pusilla affinis*, Spotless Crake P. *tabuensis plumbea* and South Island Fernbird *Bowdleria punctata punctata*. The swamp is especially important for the fernbird, and supports a large population. The Ohinetamatea River and several of its tributaries flow through the swamp, and provide open water habitats for Paradise Shelduck *Tadorna variegata*, Mallard *Anas platyrhynchos* and Grey Duck *A. superciliosa*. Shallow water and swampy areas with low vegetation provide feeding areas for White-faced Heron *Egretta novaehollandiae*, Kotuku (Great Egret or White Heron) *E. alba* and *Pukeko Porphyrio porphyrio melanotus.*

The Giant Kokopu *Galaxias argenteus*, a threatened species of fish with a very local distribution, has been recorded in the Ohinetamatea River. Black Creek, a tributary of the Ohinetamatea River, is one of the most important habitats known for-the threatened Short-jawed Kokopu *Galaxias postvectis*. The Longtailed Bat *Chalinolobus tuberculatus* occurs in the area, and is associated with mature kahikatea forest.

Noteworthy flora: Information is lacking on noteworthy plant species, but the wetland is notable for the diversity of communities present. Of particular importance is the lowland podocarp/kahikatea swamp forest community, which is a nationally diminishing habitat type.

Scientific research and facilities: Nothing significant. Conservation education: Nothing significant.

Recreation and tourism: The wetland is occasionally used for recreational trout fishing, canoeing and duck shooting. A guiding concession operates for canoe trips through the wetland, but involves only low numbers of visitors.

Management authority: The Department of Conservation (West Coast Conservancy) is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources and the preparation of coastal plans. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and gamebird hunting.

Jurisdiction: Territorial: West Coast Regional Council and Westland District Council. Functional jurisdiction for conservation: Department of Conservation.

References: Coker & Imboden (1980); Department of Conservation (1986, 1988b); Main et al. (1985); O'Donnell & Dilks (1986).

Reasons for inclusion:

1a Ohinetamatea Swamp is a particularly good example of an inland freshwater swamp in the West Coast region, a wetland type characteristic of New Zealand.

2a The swamp supports populations of two threatened species of fish, *Galaxias argenteus* and *G. postvectis*, and a threatened species of bird, *Botaurus poiciloptilus*.

2b The swamp supports a number of scarce and local species, including several species of fish and birds and a species of bat (*Chalinolobus tuberculatus*), and is thus of special value for maintaining the genetic and ecological diversity of the region.

Source: Steven O'Dea, John Lyall and Don Neale.

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Tawharekiri Lakes (53)

Location: 43°50'S, 169°05'E. 6.3 km northeast of Haast township, South Westland, West Coast, South Island.
Area: c.1,860 ha. Altitude: 25 m.
Overview: The Tawharekiri Lakes, also known as Maori Lakes Complex, is a large wetland with a parallel series of shallow ponded "lakes" in a Holocene coastal duneland. The high quality unmodified wetland provides habitat for several nationally threatened species. There are distinct and very significant ecological zonations caused by grades in drainage, age and soil development.
Physical features: The Tawharekiri Lakes complex was formed as a result of successive progradation of the coastline over the last 8,000-10,000 years, which has impeded drainage from the Mataketake Range to the sea. The "lakes" are a parallel series of shallow (0.8 m) and warm ponded water bodies and tributaries lying in the "slacks" or low-lying land between dunes. The 70 sq.km catchment is unmodified podocarp forest on the lowland flats with mixed Silver Beech Nothofagus menziesii and podocarp forest and pure Silver Beech forest on the steeper slopes of the Mataketake Range. Water in the wetland derives from direct precipitation, groundwater flows and from minor streams draining the eastern slopes of the Mataketake Range. The wetland is drained to the north by the Maori River, a slow stream that flows into the Waita River near the coast. The climate is probably similar to that at Haast township, with dominant westerly winds and an average annual rainfall of about 3,500 mm.
Ecological features: The area of prograded sand dunes contains complex successional sequences from lagoon to podocarp forest, repeated in a chronological series. The main communities and dominant plant species are as follows:

- lake margins: Tall Spike-rush *Eleocharis sphacelata*;
- infertile mire: Wire-rush *Empodisma minus, Gleichenia dicarpa, Baumea* spp. and *Dracophyllum longifolium;*
- fertile mire: Manuka *Leptospermum scoparium, Myrsine divaricata*, New Zealand Flax *Phormium tenax* and *Coprosma* spp. (small-leaved);
- river levees: New Zealand Flax, Manuka, *Carex* spp., *Coprosma* spp. and *Plagianthus betulinus.*

There are distinct zonations, from the wet lake margins to the drier river levees and dune crests, and a chronological zonation extending from the coast toward the older dunes in the east through infertile mire and fertile mire to Kahikatea *Dacrycarpus dacrydioides* forest. These ecotones and floristic gradients associated with the transition from mire communities to dune crest forest in beach ridge sequences are little understood and are of high ecological significance.
Land tenure: The wetland and surrounding areas are Crown land.
Conservation measures taken: The wetland and surrounding areas have been gazetted as Stewardship Area, and are managed by the Department of Conservation.
Conservation measures proposed: The wetland and surrounding areas are under investigation for national park status (under Section 8 of the National Parks Act 1980). National Parks provide some of the highest level of land protection in New Zealand.
Land use: The high natural and scenic values make the wetland an ideal location for outdoor recreational, the main activities being scenic appreciation and canoeing. Commercial fishing for eels *Anguilla* spp. occurs in the wetland. The forests in the surrounding area are used primarily for hunting and tramping. There is no residential occupation around the wetland or in its catchment area.
Possible changes in land use: None foreseen.

Disturbances and threats: Commercial eeling may have an effect on the eel population. No other potential threats are known.
Hydrological and biophysical values: Few details are available. The wetland acts as an important natural reservoir of storm and flood waters from adjacent hill slopes; it plays a general role in recharge and discharge of groundwater and supports food chains important to indigenous birds and diadromous fish. Social and cultural values: The area provides unique opportunities for canoeing, giving access to a large wetland complex.
Noteworthy fauna: The Tawharekiri Lakes (or Maori Lakes complex) were assessed as an "outstanding" "Site of Special Wildlife Interest" (SSWI) by the Fauna Survey Unit of the New Zealand Wildlife Service, because of the size and diversity of the wetlands. This is a nationwide wildlife habitat ranking system officially recognised by the Department of Conservation. These large isolated wetlands are especially important for their indigenous fish populations and the diversity of waterfowl present.
The lakes contain large populations of whitebait *Galaxias* spp. and eels *Anguilla* spp., and the Giant Kokopu *Galaxias argenteus*, a threatened endemic species, is present. Notable waterfowl include Great Crested Grebe *Podiceps cristatus australis* and Australasian Bittern *Botaurus poiciloptilus*.
The wetlands provide good breeding habitat for Black Swan *Cygnus atratus*, Paradise Shelduck *Tadorna variegata*, New Zealand Scaup *Aythya novaeseelandiae* and South Island Fernbird *Bowdleria punctata punctata*. Bar-tailed Godwit *Limosa lapponica* regularly feed in the area; this is the only known inland feeding habitat for this species in New Zealand. Other waterfowl occurring at the wetlands include White-faced Heron *Egretta novaehollandiae*, Great Egret or White Heron *E. alba*, Mallard *Anas platyrhynchos*, Grey Duck *A. superciliosa*, New Zealand Shoveler *A. rhynchotis variegata*, Pukeko *Porphyrio porphyrio melanotus* and possibly crakes.
Noteworthy flora: No threatened plant species are known to occur, but it is likely that the vulnerable New Zealand Water Milfoil *Myriophyllum robustum* occurs here, as it is known to be abundant nearby. The presence of both Silver Beech *Nothofagus menziesii* and Mountain Beech *N. solandri* var. *cliffortioides* in the mire ecotones of the lake is of ecological significance.
Scientific research and facilities: No current research is under way and no facilities exist.
Conservation education: No conservation education programmes are currently under way.
Recreation and tourism: The area supports a significant whitebait fishery and provides exceptional opportunities for canoeing.
Management authority: The Department of Conservation (West Coast Conservancy) is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.
Jurisdiction: Territorial: West Coast Regional Council and Westland District Council. Functional jurisdiction for conservation: Department of Conservation, Haast Field Centre.
References: Coker & Imboden (1980); Davis (1987); Department of Conservation (1986, undated-a); Johnson et al. (1979); O'Donnell & Dilks (1986); Taylor & Main (1987).
Reasons for inclusion:

1a The Tawharekiri Lakes are a good representative example of a complex of freshwater swamps and lakes traversed by creeks, wetland types characteristic of New Zealand.

2a The wetlands support populations of a threatened species of fish, *Galaxias argenteus*, and a threatened species of bird, *Botaurus poiciloptilus*.

2b The wetlands are of special value for maintaining the genetic and ecological diversity of the region, because of their successional vegetation sequences and the diversity of their bird life.

2c The wetlands are of special value as breeding habitat for various indigenous species of fish and waterfowl.

2d The wetlands are of special value for their endemic species of fish and birds, including *Galaxias argenteus, Tadorna variegata, Aythya novaeseelandiae* and *Bowdleria punctata*.

Source: Chris Woolmore, John Lyall and Don Neale.

Burmeister Morass (54)

Location: 44°00'S, 168°44'E. 9 km east-southeast of Jackson Bay, South Westland, South Island.

Area: c.2,300 ha. Altitude: 15 m.

Overview: A large indigenous forest and coastal swampland lying on a prograded beach surface; the southernmost example, and one of the largest examples, of a "pakihi" swamp. The swamp lies entirely within the Burmeister Ecological Area, and is important for its successional vegetation sequences and unmodified state.

Physical features: Burmeister Morass is a large coastal swampland lying on a prograded beach surface between the Arawhata and Waiatoto Rivers, and partly surrounding the granitic dome of Mount McLean. The area consists of a series of fossil beaches and dune ridges left by the prograding coastline, which are separated from each other by low-lying boggy ground in the dune "slacks".

The wetland is bounded in the north by forested dunes fronting the Tasman Sea, in the southwest by the Arawhata River flats, in the southeast by the base of the Haast Range, and in the northwest by Mount McLean, Mount Hindley and Jack Creek. The wetland includes the areas known as Sponge Swamp and Dismal Swamp. It is fed mostly by direct rainfall and by groundwater sources, and is drained by several slow-flowing streams running into the Arawhata and Waiatoto Rivers.

Ecological features: The Burmeister Morass is an exceptionally large area of natural "pakihi" swamp, representing the southern limit of this habitat type. Pakihi are a type of wetland seldom occurring outside the West Coast region, and are characterised by poor drainage, and low fertility. The Morass contains a complete primary successional vegetation sequence from open bog to podocarp forest, arising from the complex patterns of post-glacial sediment deposition and topography. The sequence has been described by Mark and Smith (1975) as follows:

- a "pakihi" bog surface dominated by Wire Rush *Empodisma minus* and open water, with Tangle Fern *Gleichenia circinata*, *Baumea teretifolia*, Manuka *Leptospermum scoparium* and Inaka *Dracophyllum longifolium*;
- young Manuka on pakihi fringe;
- Manuka woodland;
- Silver Pine *Lagarostrobus colensoi* woodland;
- young Rimu *Dacrydium cupressinum* stands;
- mature lowland forest of emergent Rimu, Kahikatea *Dacrycarpus dacrydioides* and Miru *Prumnopitys ferruginea* above a separate stratum of Silver Beech *Nothofagus menziesii* and Kamahi *Weinmannia racemosa*.

Ecologically and scientifically important soil sequences are associated with this vegetation sequence. The wetland is mostly surrounded by dense podocarp forest.

Land tenure: The entire wetland is Crown land, gazetted as Stewardship Area but proposed as an Ecological Area. A large proportion of the land surrounding the proposed Ecological Area is also Crown land, gazetted as Stewardship Area and managed by the Department of Conservation. Small parts of the nearby Arawhata and Waiatoto River beds are privately owned.

Conservation measures taken: Burmeister Morass has been gazetted as Stewardship Area, and is managed by the Department of Conservation. The site is within the South West New Zealand World Heritage Area.

Conservation measures proposed*:* The Morass is a proposed Ecological Area. This status was proposed in 1977, but the final status of the site awaits a national park investigation over the wider South Westland. National park status is a possibility for the swamp, if Mount Aspiring National Park is extended to the sea.

Land use: As access is not easy to most of the area, the wetland attracts little public use. However, the Haast-Jackson Bay Road traverses the southeastern portion of the area, and the forest landscape there is of high scenic importance. Much of the surrounding area is also heavily forested and attracts little public use. Some recreational deer hunting occurs in the area.

Possible changes in land use: None foreseen at the wetland. A proposed water pipeline would pass through the forest in the proposed Ecological Area should it proceed.

Disturbances and threats: Fire has affected that part of the wetland to the southeast of the road. Sphagnum moss has been harvested from the wetland.

Hydrological and biophysical values: The wetland plays a general role in recharge and discharge of groundwater.

Social and cultural values: Nothing significant.

Noteworthy fauna: Burmeister Morass was identified as a "Site of Special Wildlife Interest" (SSWI) and assessed as being of "high" value by the Fauna Survey Unit of the New Zealand Wildlife Service. This is a nationwide wildlife habitat ranking system officially recognised by the Department of Conservation. The wetland is known to support high numbers of South Island Fernbird *Bowdleria punctata punctata* and a range of other passerines. The adjacent major rivers support a wide range of native fish species, and it is likely that some of these use the wetland.

Noteworthy flora: Extensive botanical studies of the vegetation sequences of the Burmeister Morass and surrounding areas have emphasised the very high botanical importance of the area, particularly as a primary successional vegetation sequence.

Scientific research and facilities: Several studies of the botany, pedology and fauna of the area have been carried out, mostly by the former Department of Scientific and Industrial Research (DSIR). The proposed Ecological Area designation recognises the scientific value of the area.

Conservation education: The area has high potential value for conservation education. A public road between Haast and Jackson Bay traverses the vegetation sequence, so that access to that part of the wetland is relatively easy.

Recreation and tourism: The scenic values of the wetlands and forest of the Burmeister Morass are very high. Several features of the Jackson Bay area are currently being developed to attract more nature-based tourism to this region. Management authority: The Department of Conservation (West Coast Conservancy) is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and game-bird hunting.

Jurisdiction: Territorial: West Coast Regional Council and Westland District Council. Functional jurisdiction for conservation: Department of Conservation. References: Coker & Imboden (1980); Department of Conservation (1986); Johnson et al. (1979); Mark & Lee (1985); Mark & Smith (1975); Scott & Rowley (1975).

Reasons for inclusion:

1a Burmeister Morass is a particularly good example of a natural "pakihi" wetland containing a complete vegetation sequence from open bog to mature forest. Unmodified "pakihi" is now uncommon in New Zealand. It is a valuable part of a complex of high quality lowland wetlands extending for some 45 km from the Arawhata River in the south to the Waita River in the north.

Source: Don Neale and John Lyall.

Hermitage Swamp (55)

Location: 44°03'S, 168°23'E. 22 km south-southwest of Neils Beach, South Westland, West Coast, South Island.

Area: C.1,300 ha. Altitude: 30 m.

Overview: Hermitage Swamp is a largely pristine wetland situated on the floodplain of the lower Cascade River. It is likely to contain the Giant Kokopu *Galaxias argenteus*, and has national significance as a habitat for indigenous fish species.

Physical features: The wetland lies on a broad floodplain of very low gradient dominated by the Cascade River. The floodplain consists of alluvial gravels and silts resting on a Pleistocene glacial till, and is bounded to the north by the Cascade Plateau ultramafic glacial moraine, and to the south by the ultramafic Red Hills.

Water in the wetland probably derives from direct precipitation, groundwater flows and backing up of the Cascade River due to tidal influences. The climate is probably similar to that at Haast township, with dominant westerly winds and an average annual rainfall of about 3,500 mm.

Ecological features: The wetland contains complex zonations of vegetation which incorporate infertile mire, fertile mire river levee, broad-leaved forest, podocarp forest and mixed podocarp/beech (*Nothofagus* spp.) forest.

The dominant species in the infertile mire are Wire-rush *Empodisma minus*, *Gleichenia dicarpa*, *Baumea* spp. and *Dracophyllum longifolium*. Dominant species in the fertile mire and levee broad-leaved forest include Manuka *Leptospermum scoparium*, New Zealand Flax *Phormium tenax*, *Coprosma* spp., *Carex* spp., *Carmichaelia arborea* and *Plagianthus betulinus*. Both the wetland and adjacent forest are unmodified apart from grazing.

Land tenure: The wetland and surrounding areas are Crown land.

Conservation measures taken: The wetland and surrounding areas have been gazetted as Stewardship Area, and are managed by the Department of Conservation.

Conservation measures proposed: The wetland and surrounding areas are under investigation for national park status (under Section 8 of the National Parks Act 1980). National Parks provide some of the highest level of land protection in New Zealand.

Land use: Commercial fishing for eels *Anguilla* spp. occurs in the swamp. In the past, there has been some harvesting of sphagnum moss, but this no longer occurs. Commercial deer hunting (for Red Deer *Cervus elaphus*) occurs in the neighbouring forested and unforested areas, and also takes place infrequently in the drier areas of the swamp. Access to the

Cascade River area is difficult as there is only one road (to the middle reaches of the valley), and the human population there is very low, with a few houses mostly at the Cascade River mouth. Cattle are grazed on the Cascade River flats, but it is not known if they enter Hermitage Swamp. Harvesting of whitebait *Galaxias* spp. is undertaken on a large scale in the tidal reaches of the Cascade River.

Possible changes in land use: A proposal to form a road between Hollyford and Jackson Bay, perhaps via the Cascade Valley, has been suggested by a number of groups, but the proposal is still at an early stage. The road may impinge on the wetland, but this is not as yet confirmed. No decision has yet been made for the construction of this road.

Disturbances and threats: As a result of the wetland being very isolated and the lack of information available, possible threats are not well known. The continued colonisation of the forests by the Australian Brushtail Possum *Trichosurus vulpecula* poses a serious threat to forest structure.

Hydrological and biophysical values: Hermitage Swamp is in the floodplain of the Cascade River, and acts as a natural water storage reservoir. The tidal reaches of the Cascade River are a major spawning area for whitebait *Galaxias* spp., and support the biggest whitebait fishery in New Zealand, with the catch on the river representing approximately half the total catch on the West Coast.

Social and cultural values: Major archaeological sites have been found at Cascade Lagoon on the periphery of the wetland. The neighbouring coastal and river beaches were a source of Pounamu (jade) to Maori. There is evidence of prehistoric use of cockle *Chione stutchburyi* and pipi *Paphies australe*. These shellfish are a common food source of the Maori. The remains of a flax mill, built in 1905, are located at the lagoon. The area is extremely isolated and receives little recreational use.

Noteworthy fauna: The wetland is part of a habitat of national importance for indigenous bird and fish species. Little information is, however, available on the wildlife and other ecological values of the swamp. It is known to provide important habitat for adult and juvenile whitebait *Galaxias* spp. It is a largely pristine wetland, and is likely to contain the Giant Kokopu *Galaxias argenteus*, a threatened species of fish. Large stocks of eels Anguilla spp. are also likely to be present.

Noteworthy flora: No threatened species of plants are known to occur in the wetland. The vulnerable Water Milfoil *Myriophyllum robustum* is likely to be present.

Scientific research and facilities: No research facilities exist. Conservation education: None.

Recreation and tourism: Virtually no recreation and tourism occur at the wetland because of its isolation.

Management authority: The Department of Conservation (West Coast Conservancy) is responsible for the management of Crown land and wildlife. The West Coast Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources and the preparation of coastal plans. The West Coast Fish and Game Council manages sport fishing (trout and salmon) and gamebird hunting.

Jurisdiction: Territorial: West Coast Regional Council and Westland District Council. Functional jurisdiction for conservation: Department of Conservation, Haast Field Centre.

References: Department of Conservation (1986); Johnson & Lee (1977); Johnson *et al*. (1979).

Reasons for inclusion:

1a Hermitage Swamp is a good representative example a freshwater swamp and bog complex, a wetland characteristic of the Haast region of the West Coast of New Zealand.

2b The swamp supports a number of indigenous species of fish, and is thus of special value for maintaining the genetic and ecological diversity

2c The swamp is of special value as a nursery area for whitebait *Galaxias* spp .

Source: Chris Woolmore, John Lyall and Don Neale.

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