Norfolk Island airport upgrade: biosecurity risks of imported rock aggregate to an island environment

A report to the Council of Elders, Norfolk Island

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Introduction

An emerging issue for Norfolk Island is the need to upgrade the existing runways and aprons of the airport, using rock aggregate bonded with asphalt. The source of aggregate is a point of concern and discussion within the Norfolk community due to opposing views as to whether locally sourced rock or imported aggregate should be used. The key concern about imported aggregate relates to potential biosecurity risks. This report provides information to support community discussion on this issue. The economic costs and benefits associated with either locally quarried rock or imported rock aggregate is outside the scope of this report.

Rock aggregate

Rocks which have been crushed and screened to a uniform size can be added as aggregate to a bonding material, such as bitumen for road or tarmac pavement, or to cement to form concrete. The rock material must meet a number of physical and chemical standards, and these will vary according to their end use. Aggregates to be used as road metal on roads and airstrips must be fresh, have high strength and durability, be resistant to *abrasion*, the *polishing* action of traffic (which influences skid resistance), sudden *impact* and *crushing* under a gradually applied load. It should not contain a large proportion of platy or elongated particles. The aggregate should also have a rough surface to optimise bonding with bitumen. It is also desirable for visual safety that aggregates are dark in colour.

These properties of an aggregate are related to the texture and mineral composition of the rock. Most igneous and contact metamorphic rocks (such as hornfels and quartzite) meet the requirements for good road 'metal'. However, basic igneous rocks, especially basalt, are considered the most suitable for these purposes (Gribble and MacLean, 1985; Bell, 2004). Representative values of aggregate properties according to rock type are provided in Table 1, below. Assessment of the suitability of rock for aggregate requires testing and analysis by a suitably qualified engineering geologist or geo-technician at a certified laboratory.

Table 1 Representative values of some common aggregates (after Bell, 2004)[1]

Rock type	Aggregate crushing value(a)	Aggregate impact value (b)	Aggregate abrasion value (c)	Polished stone value (d)
Basalt	14	13	14	58
Dolerite	10	9	6	55
Granite	17	20	15	56
Hornfels	13	11	4	59
Limestone	14	20	16	54

Geology of Norfolk Island

The geology of Norfolk Island has been described by Jones and MacDougall (1973), Green (1973), and Abell and Falkland (1991). The island is composed almost entirely of basalt lavas associated with eruptions from the summit areas of Mount Pitt and Mount Bates. These basalts were erupted during three main periods between 3 and 2.3 million years ago, but chemically, there does not appear to be 'regular change' in chemical composition (Green, 1973), although variations in the rocks can be attributed to the type and environmental setting of eruptions (for example, whether they were lavas or ash; sheet lavas flowing over the ground surface; or, lavas being quenched by seawater). Four volcanic formations have been described by Jones and MacDougall (1973).

- **Duncombe Bay Basalt**, limited to the north coast in the vicinity of the Captain Cook Monument
- **Cascade Basalt** comprising thick lava flows, often as columnar or tabular seacliffs along the northern and western coastlines, with the type location at Cascade Pier. This formation is typically underlain by yellow volcanic tuffs (ash beds)
- **Steels Point Basalt** which is thickest at the type location of Steels Point, and is essentially indistinguishable from the Cascade Basalt, including the underlying yellow tuffs.
- **Ball Bay Basalt** is located only on the eastern coastline between Collins Head and Steels Point and is overlain by the Steels Point Basalt.

The only non-volcanic rock on the island is located in the vicinity of Kingston where a thick sequence of limestone as calcarenite (cemented sand sized particles of calcium carbonate as shell and coral fragments that have been transported by wind and/or water) occurs as a wave cut platform with some outcropping on the landward coastline. There is also some organic-rich black clays at Cemetery and Slaughter Bays which formed in a wetland or lagoonal environment approximately 4000 years ago (Truswelll (1981) and Rich et al, (1983) in Abell and Falkland, 1991). In the past a quarry has extracted Cascade Basalt, and it is assumed that aggregate in the current airport runway and aprons has been sourced from that location.

[1] (a) relative measure of resistance to crushing under a gradually applied compressive load – a lower value is preferred (b)relative measure of resistance to sudden impact – lower values are preferred (c) the lower the value the greater the resistance to surface wear by abrasion (d) resistance to polishing – higher values are preferred

Rock quarrying and aggregate contamination

Identification of a suitable site for quarrying rock for aggregate requires comprehensive assessment that describes the rock type and structure (eg joints, boundary features, dykes etc), weathering grade, access, groundwater conditions, overburden thickness and topography. Suitability of a site will be dependent on:

(a) Quality of the rock material (that is, its physical and chemical properties and suitability for use). Regardless of the purpose for which the rock is needed, the quarry must be located in areas of shallow weathering.to ensure the rock is fresh and to reduce costs of quarrying (also see (c) below);

(b) Adequate supply over time; and

(c) Economics of production and transport. One of the most important factors, which may make a resource extraction operation economically prohibitive is the cost of transportation of the product from its source to the point of supply/use. Other economic factors may include labour costs/availability, poor drainage conditions in the quarry and the amount of stripping of overburden required to expose the fresh rock.

When rock is extracted at a quarry that meets all requirements, it is fed into a crusher and then screened to separate the broken rock into different grade sizes which are then stockpiled. Once stockpiled into these distinct size fractions, the aggregate can be transported for use. Stockpiling and transport is usually a multi-stage process from source to final destination.

Quarrying operations need to minimise environmental impacts of rock extraction, crushing and stockpiling. This should include controlling contamination by weeds on-site, and of the aggregate itself by organic matter and soil. Quarrying Codes of Practice should be applied, which differ in detail across jurisdictions, but include guidelines to protect the environment including practices such as washing down of heavy equipment to minimise the risk of transporting soil and weed seeds off-site. The risk of contamination occurs on-site, during transport and particularly stockpiling when soil and organic material can adhere to aggregates via heavy equipment, contact with ground surfaces, and through runoff and wind processes. Stockpiling of aggregates can occur at various locations prior to delivery at the final destination, indicating multi-stage contamination risks. Contamination by soil and organic matter will potentially introduce weed seeds, invertebrates and soil pathogens to the aggregates. Soil pathogens may include bacteria, fungi and moulds, some of which will be important agricultural and plant pests. Understanding the biosecurity risks associated with this type of contamination is very relevant when aggregates are being exported from one jurisdiction to another. Such risks do not occur when aggregate is locally produced and used.

Import Regulatory Systems to prevent introduction of pest species

The aggregate industry worldwide is highly lucrative and expanding in response to infrastructure development and maintenance. Global sales of aggregates were forecasted to total ~53 billion metric tonnes in 2017 increasing to ~66 billion metric tonnes by 2022 (Kuhar, 2014). The export and import of aggregates is a significant worldwide trade with the largest exporters being the UAE

(USD601M) and China (USD294M) (OEC, 2019). The importation of aggregate needs to comply with import regulatory systems of the receiving jurisdiction that might exist in the form of phytosanitary legislation, import health standards (IHS), biosecurity import conditions systems (BICON) or their equivalent for the destination country, and these are generally issued under customs, biosecurity and/or plants protection acts of legislation[2]. The FAO provides guidelines for phytosanitary import regulatory systems (FAO, 2004). Compliance is the responsibility of the *exporter*. Material that does not meet the import requirements will not be issued with biosecurity clearance. In the case of non-compliance, the importer has the option to treat, reship, or destroy the consignment. For example, the Director of Biosecurity in Vanuatu refused entry of a consignment of aggregate from China in August 2017, due to concerns about contamination by Foot and Mouth Disease. The material was then reshipped to Africa by the exporter[3].

Biosecurity issues surrounding contaminated imported aggregate

Aggregate that has not met the requirements of quarrying Codes of Practice or biosecurity regulatory frameworks, but have been permitted entry, can introduce exotic and pest species to the receiving environment. This can be through the contamination of aggregate with soil and organic material containing 'hitch hiker species' as weed seeds, micro- and macro-invertebrates, soil pathogens and possibly small vertebrates from the point of origin, during stockpiling and transport. 'Hitch hiker' species are defined as agricultural pest organisms contaminating a commodity (such as aggregate), and/or are on the transport conveyance (eg ship, plane) or shipping containers (Dale and Maddison, 1984; Gadgil et al, 2000, 2002). Such contamination has been recorded in Palau and Majuro Atoll in the Pacific (Space et al, 2003; McKenzie et al, 2006). However, it should be noted that there is a dearth of literature regarding the specific biosecurity risks of aggregate import. Despite this, aggregate will have biosecurity risks associated with its potential contamination by soil and organic matter, and any imported material would require evidence to demonstrate that it had been treated according to requirements, and tested prior to unloading.

For Norfolk Island, a significant biosecurity risk with imported aggregate would be the entry of *Phytophthora cinnamomi.* This plant root pathogen is a mould that has been described as '*one of the world's worst plant pathogens*' (Burgess et al, 2017). It grows as microscopic filaments using the infected plant's root and basal stem tissue as a source of energy, resulting in localised rotting. This prevents the flow of water and nutrients ultimately weakening or killing the plant. It has a very wide range globally, affecting horticultural and agricultural plants, forests and woodlands across Europe, the Americas, South Africa, Australia, New Zealand, and Asia (King et al, 2010; Anonymous, 2015; Burgess et al, 2017). Its origin remains uncertain, but is assumed to have been SE Asia and was first identified, in 1922, as the cause of disease in cinnamon trees in Sumatra, Indonesia (Robertson, 1970). It is believed to have been spread by humans through trade, especially but not exclusively via soil, plants and food products, and is recognised as having been an invasive species for 100 years (Anonymous, 2015). The distribution of *Phytophthora cinnamomi*, the ideal conditions for its

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[2] For examples of different IHSs refer to the following: http://www.sainthelena.gov.sh/wp-content/uploads/2013/09/Rock-stone-sand-and-pebbles-import-health-standard-DRAFT.pdf , https://www.biosecurity.govt.nz/importing/soil-rock-and-water/ ;

[3] (https://www.radionz.co.nz/international/programmes/datelinepacific/audio/201855288/vanuatu-biosecurity-director-wants-chinese-gravel-gone)

proliferation, and processes of plant infection are well understood, as is its status as a highly invasive species. Of significance for this report, it should be noted that most of 'the large centres of infestation that exist today in southern temperate Australia occurred as a result of human activity, often as a direct result of the introduction of **infested soil or road-building materials** to vulnerable un-infested areas (O'Gara et al., 2005a:3). In the *Phyphthora cinnamomi* National Best Practice Guidelines for Australia (O'Gara et al., 2005b: Table 5.4, pp38-40), management options for the construction and maintenance of roads/tracks and other infrastructure specifically include:

Avoid the importation of basic raw material, but if unavoidable use disease-free or low-risk construction materials.

Within Australia, relevant legislation that can be implemented for the management of *Phytophthora cinnamomi* is enacted at both Federal and State levels. One of the most powerful pieces of legislation in Australia that protects biodiversity is the *Environment Biodiversity and Conservation Act, 1999* (commonly referred to as the EPBC Act). *Phytophthora cinnamomi* is listed in this Act as a national 'key threatening process.'

An important quarantine survey of Norfolk Island was undertaken in 2012-14 (Australian Government Department of Agriculture, nd; Maynard et al, 2018). This survey documents the pests and diseases present and absent on the island during 2012-2014 (Maynard et al, 2018:8), and as such, it provides a critically important baseline. According to this survey, *Phytophthora cinnamomi* was *not present* on the island.

A study by Robertson (1970) tested the susceptibility of a range of both exotic and native plants common in New Zealand, including Norfolk Pine (*Araucaria heterophylla*). Eight months after being inoculated with *Phytophthora cinnamomi,* the Norfolk Pine trees in this study were 'severely infected' with the pathogen, 'with evidence of root rot, stunting and needle chlorosis' [4] (Robertson, 1970: 305). This result indicated a high susceptibility of *Phytophthora cinnamomi* to the pathogen.

Importing road aggregate to Norfolk Island runs the risk of introducing *Phytophthora cinnamomi* to the island. This highly invasive mould, once introduced, has the potential to impose a number of significant environmental, economic and cultural impacts including:

(a) Reduced viability and productivity of food crops including fruit and vegetables, and hence, food security of the island.
(b) Dieback of Norfolk Pines, which have both cultural and environmental significance. Any loss of these trees would be associated with cascading ecological effects due to the important role they have on the nesting of migratory seabirds including the Little Tern (*Sternula albifrons)* and the Sooty Tern (*Onychoprion fuscatus*). Both of these species are included in the EPBC Act 1999 under s248.
(c) Dieback of other endemic (native) plant species, many of which are vulnerable, endangered, or critically endangered, and are listed as such in the EPBC Act 1999. A list of these species is provided as an appendix to this report.

[4] A browning of the needles due to a lack of chlorophyll

Conclusion

The need for airport upgrade on Norfolk Island draws to attention the vulnerability of an island environment to introduced pest species, in this case, the import of potentially contaminated rock aggregate. A number of biosecurity risks are associated with rock material importation, and these are widely recognised. One of the most important potential biosecurity risks is, in my opinion, *Phytophthora cinnamomi* which currently has not been identified on the island but if introduced could have significant cultural, economic and environmental impacts. Given the listing of a number of species found on Norfolk Island in the EPBC Act 1999, and that *Phytophthora cinnamomi* is listed in this Act as a national 'key threatening process' it is relevant that the Norfolk community be aware of the following: any activity or action that might threaten a species or an ecological community that is listed under the EPBC Act must be referred to the Australian Government Department of the Environment and Energy for assessment.

References

Abell, RS and Falkland, AC, 1991 The hydrogeology of Norfolk Island, South Pacific Ocean. Department of Primary Industries and Energy and Bureau of Mineral Resources, Geology and Geophysics Bulletin 234AGPS, Canberra.

Anonymous, 2015 *Phytophthora cinnamomi* (PHYTCN) [World distribution] EPP) Global database. EPPO/CABI

Australian Government Department of Agriculture, nd Norfolk Island quarantine survey 2012-2014: a report to the Australian Government Department of Infrastructure and regional development.

Bell, FG, 2004   Engineering geology and construction. Spon Press, London. 797pp.

Burgess, TI Scott, JK, Mcdougall, KL, Stukely, MJC, Crane, C Dunstan, WA, Brigg, M ,Andj, I C , White, D, Rudman, T , Arentz, F , Ota, N and Hardy, G, 2017 Current and projected global distribution of *Phytophthora cinnamomi*, one of the world's worst plant pathogens. *Global Change Biology,* 23: 1661-1674

Dale, P. S. and P. A. Maddison. 1984. Transport services as an aid to insect dispersal in the South Pacific, pp. 225-256. In: M. Laird [ed.], Commerce and the Spread of Pests and Disease Vectors. Praeger Publishers, New York.

FAO,2004 Guidelines for a phytosanitary import regulatory system. International Standards for Phytosanitary Measures: ISPM 20. Secretariat of the International Plant Protection Convention (IPPC)

Gadgil, P. D., L. S. Bulman, R. Crabtree, K. L. Glassey, J. C. O'Neil, and R. N. Watson. 2000. Significance to New Zealand forestry of contaminants on the external surfaces of shipping containers. *New Zealand Journal of Forestry Science* 30:341- 358.

Gadgil, P. D., L. S. Bulman, and K. L. Glassey. 2002. Quarantine risk associated with air cargo containers. *New Zealand Journal of Forestry Science* 32:28-42.

DSE , 2008 Victoria's public land *Phytophthora cinnamomi* management strategy. Department of Sustainability and Environment, Melbourne.

Green, TH, 1973 Petrology and geochemistry of basalts from Norfolk Island. *Journal of the Geological Society of Australia,* 20 (3): 259-271

Jones, JG and McDougall, I, 1973 Geological history of Norfolk and Phillip Islands, southwest Pacific Ocean. *Journal of the Geological Society of Australia,* 20 (3): 239-254

King, MK, Reeve, M, Van der Hoek, MB, Williams, N, McComb, J, O'Brien, PA, and Hardy, GE, 2010 Defining the phosphite-regulated transcriptome of the plant pathogen *Phytophthora cinnamomi Molecular Genetics Genomics* **284**:425–435

Kuhar, M, 2014 World aggregates market. http://www.rockproducts.com/features/13045-world-aggregates-market.html#.XFtKilwzaUk viewed 7/2/2019

McKenzie E, Woodruff, A and McClennen, C, 2006 Economic assessment of the true costs of aggregate mining in Majuro Atoll, Republic of the Marshall Islands. SOPAC Technical Report 383.

Maclean, AC and Gribble, CD 1985 Geology for civil engineers. Allen and Unwin, London. 310pp.

Maynard, G.V., Lepschi, B.J. and Malfroy, S.F. (2018). Norfolk Island quarantine survey 2012-2014 – a comprehensive assessment of an isolated subtropical island. *Proceedings of the Linnean Society of New South Wales* 140, 7-243

OEC, 2019 Gravel and crushed stone trade. https://atlas.media.mit.edu/en/profile/hs92/2517/ viewed 7/2/2019

O'Gara E, Howard K, Wilson B & Hardy G, 2005 Management of Phytophthora cinnamomi for biodiversity conservation in Australia: Part 2—National best practice guidelines, a report funded by the Commonwealth Government Department of the Environment and Heritage by the Centre for Phytophthora Science and Management, Murdoch University, Western Australia.

Robertson, GI, 1970 Susceptibility of exotic and indigenous trees and shrubs to *Phytophthora cinnamomi* rands, *New Zealand Journal of Agricultural Research*, 13(2): 297-307

Space, JC, Waterhouse, BM, Miles, JE, Tiobech, J and Rengulbai, K, 2003 Report to the Republic of Palau on invasive plant species of environmental concern. USDA Forest Service Honolulu, Hawai'i.

Yugovic, J, 2018 Imported geological material in natural areas: impacts and management. http://www.spiffa.org/uploads/2/6/7/5/2675656/imported_geological_material_in_natural_areas_january_2018.pdf

Appendix EPBC Act Threatened Species in Norfolk Island

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Species	Common Name	Category	Type of Presence
Abutilon julianae	Norfolk Island Abutilon	Critically Endangered	Endemic
Achyranthes arborescens	Chaff Tree, Soft-wood	Critically Endangered	Endemic
Achyranthes margaretarum	Phillip Island Chaffy Tree	Critically Endangered	Endemic
Advena campbellii	Campbell's Helicarionid Land Snail	Critically Endangered	Present
Balaenoptera musculus	Blue Whale	Endangered	Present
Blechnum norfolkianum	Norfolk Island Water-fern	Endangered	Endemic
Boehmeria australis subsp. australis	Tree Nettle, Nettletree	Critically Endangered	Endemic
Calystegia affinis		Critically Endangered	Present
Carcharodon carcharias	White Shark, Great White Shark	Vulnerable	Present
Caretta caretta	Loggerhead Turtle	Endangered	Present
Centrophorus harrissoni	Harrisson's Dogfish, Endeavour Dogfish, Dumb Gulper Shark, Harrison's Deepsea Dogfish	Conservation Dependent	Present
Chelonia mydas	Green Turtle	Vulnerable	Present
Christinus guentheri	Lord Howe Island Gecko, Lord Howe Island Southern Gecko	Vulnerable	Present
Clematis dubia	a creeper, Clematis	Critically Endangered	Endemic
Coprosma baueri	Coastal Coprosma	Endangered	Endemic
Coprosma pilosa	Mountain Coprosma	Endangered	Endemic
Cordyline obtecta	Ti	Vulnerable	Endemic
Cyanoramphus cookii	Norfolk Island Green Parrot, Tasman Parakeet, Norfolk Island Parakeet	Endangered	Endemic
Dendrobium brachypus	Norfolk Island Orchid	Endangered	Endemic
Dermochelys coriacea	Leatherback Turtle, Leathery Turtle, Luth	Endangered	Present
Diomedea antipodensis	Antipodean Albatross	Vulnerable	Present
Diomedea antipodensis gibsoni	Gibson's Albatross	Vulnerable	Present
Species	**Common Name**	**Category**	**Type of Presence**
Diomedea epomophora	Southern Royal Albatross	Vulnerable	Present

Diomedea exulans	Wandering Albatross	Vulnerable	Present
Diomedea sanfordi	Northern Royal Albatross	Endangered	Present
Dysoxylum bijugum	Sharkwood, a tree	Vulnerable	Endemic
Elatostema montanum	Mountain Procris	Critically Endangered	Endemic
Elymus multiflorus subsp. kingianus	Phillip Island Wheat Grass	Critically Endangered	Present
Epinephelus daemelii	Black Rockcod, Black Cod, Saddled Rockcod	Vulnerable	Present
Eretmochelys imbricata	Hawksbill Turtle	Vulnerable	Present
Eubalaena australis	Southern Right Whale	Endangered	Present
Euphorbia norfolkiana	Norfolk Island Euphorbia	Critically Endangered	Endemic
Euphorbia obliqua	a herb	Vulnerable	Endemic
Fregetta grallaria grallaria	White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian)	Vulnerable	Present
Galeorhinus galeus	School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark	Conservation Dependent	Present
Hibiscus insularis	Phillip Island Hibiscus	Critically Endangered	Endemic
Hoplostethus atlanticus	Orange Roughy, Deep-sea Perch, Red Roughy	Conservation Dependent	Present
Hypolepis dicksonioides	Downy Ground-fern, Brake Fern, Ground Fern	Vulnerable	Endemic
Ileostylus micranthus	Mistletoe	Vulnerable	Endemic
Lastreopsis calantha	Shield-fern, Shieldfern	Endangered	Endemic
Macronectes giganteus	Southern Giant-Petrel, Southern Giant Petrel	Endangered	Present
Macronectes halli	Northern Giant Petrel	Vulnerable	Present
Marattia salicina	King Fern, Para, Potato Fern	Endangered	Endemic
Mathewsoconcha grayi ms	Gray's Helicarionid Land Snail	Critically Endangered	Present
Mathewsoconcha phillipii	Phillip Island Helicarionid Land Snail	Critically Endangered	Present
Mathewsoconcha suteri	a helicarionid land snail	Critically Endangered	Present
Megaptera novaeangliae	Humpback Whale	Vulnerable	Present
Species	**Common Name**	**Category**	**Type of Presence**
Melicope littoralis	Shade Tree	Vulnerable	Endemic
Melicytus latifolius	Norfolk Island Mahoe	Critically Endangered	Endemic
Melicytus ramiflorus subsp. oblongifolius	Whiteywood, a tree	Vulnerable	Endemic
Meryta angustifolia	a tree	Vulnerable	Endemic

Meryta latifolia	Shade Tree, Broad-leaved Meryta	Critically Endangered	Endemic
Muehlenbeckia australis	Shrubby Creeper, Pohuehue	Endangered	Endemic
Myoporum obscurum	Popwood, Sandalwood, Bastard Ironwood	Critically Endangered	Endemic
Myrsine ralstoniae	Beech	Vulnerable	Present
Natator depressus	Flatback Turtle	Vulnerable	Present
Ninox novaeseelandiae undulata	Norfolk Island Boobook, Southern Boobook (Norfolk Island)	Endangered	Endemic
Oligosoma lichenigera	Lord Howe Island Skink	Vulnerable	Present
Pachycephala pectoralis xanthoprocta	Golden Whistler (Norfolk Island)	Vulnerable	Endemic
Pennantia endlicheri	Pennantia	Endangered	Endemic
Petroica multicolor	Norfolk Island Robin	Vulnerable	Present
Phreatia limenophylax	Norfolk Island Phreatia	Critically Endangered	Endemic
Phreatia paleata	an orchid	Endangered	Endemic
Pittosporum bracteolatum	Oleander	Vulnerable	Endemic
Planchonella costata		Endangered	Endemic
Pteris kingiana	King's Brakefern	Endangered	Endemic
Pteris zahlbruckneriana	Netted Brakefern	Endangered	Endemic
Pterodroma leucoptera leucoptera	Gould's Petrel, Australian Gould's Petrel	Endangered	Present
Pterodroma neglecta neglecta	Kermadec Petrel (western)	Vulnerable	Present
Quintalia stoddartii	Stoddart's Helicarionid Land Snail	Critically Endangered	Present
Senecio australis	a daisy	Vulnerable	Endemic
Senecio evansianus	a daisy	Endangered	Endemic
Senecio hooglandii	a daisy	Vulnerable	Endemic
Sphyrna lewini	Scalloped Hammerhead	Conservation Dependent	Present
Streblus pendulinus	Siah's Backbone, Sia's Backbone, Isaac Wood	Endangered	Endemic
Taeniophyllum norfolkianum	Minute Orchid, Ribbon-root Orchid	Vulnerable	Present
Thalassarche bulleri	Buller's Albatross, Pacific Albatross	Vulnerable	Present
Species	**Common Name**	**Category**	**Type of Presence**
Thalassarche eremita	Chatham Albatross	Endangered	Present
Thalassarche impavida	Campbell Albatross, Campbell Black-browed Albatross	Vulnerable	Present
Thalassarche melanophris	Black-browed Albatross	Vulnerable	Present
Thalassarche salvini	Salvin's Albatross	Vulnerable	Present

Thunnus maccoyii	Southern Bluefin Tuna	Conservation Dependent	Present
Tmesipteris norfolkensis	Hanging Fork-fern	Vulnerable	Endemic
Turdus poliocephalus poliocephalus	Grey-headed Blackbird, Norfolk Island Thrush	Extinct	Extinct
Ungeria floribunda	Bastard Oak	Vulnerable	Endemic
Wikstroemia australis	Kurrajong	Critically Endangered	Endemic
Zehneria baueriana	Native Cucumber, Giant Cucumber	Endangered	Endemic
Zosterops albogularis	White-chested White-eye, Norfolk Island Silvereye	Extinct	Extinct

Summary

List	Threatened Species
Search Location	Norfolk Island
Results	88 species
Category: Conservation Dependent	5 species
Category: Critically Endangered	20 species
Category: Endangered	25 species
Category: Extinct	2 species
Category: Vulnerable	36 species
Type of Presence: Endemic	44 species
Type of Presence: Extinct	2 species
Type of Presence: Present	42 species

http://www.environment.gov.au/cgi-bin/sprat/public/publicreports.pl?proc=species