NORFOLK ISLAND REGIONAL COUNCIL

STATE OF THE ENVIRONMENT REPORT

2016/17 – 2020/21

Aerial view of a valley in Ball Bay, Norfolk Island © Jim Castles

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INTRODUCTION & CONTEXT

The Norfolk Island Group (Norfolk Island, Phillip Island and Nepean Island) is a relatively remote set of oceanic islands located in the Pacific Ocean, approximately 1400 km from the Eastern Seaboard of Australia and 800 km from the nearest land mass. Norfolk Island has an area of around 3,850 ha, including the smaller Phillip and Nepean Islands, which are 190 ha and 10 ha respectively.

Norfolk Island is often defined by its soaring pine trees and jagged cliffs; however, the island also boasts stunning sandy beaches with reef-protected waters, such as Emily Bay (Figure 1) and Slaughter Bay, and surf beaches, such as Bumbora and Anson Bay (Figure 2). The Norfolk Island National Park offers views over palm forests from Mt Pitt and Mt Bates (Figure 3).

Figure 1. Emily Bay © Susan Prior

INTRODUCTION & CONTEXT

Continued

Around one-fifth of Norfolk Island is in the National Park and Botanic Garden or a public reserve. Including Phillip and Nepean Islands (which total about 200 hectares), about 23% of all land in the Norfolk Island group is within the National Park and Botanic Garden, or in one of the 19 public reserves (NIRC 2018) (Table 1 and Figure 3).

Table 1

Land Tenure	Area (ha)
Freehold	1807
Crown Leasehold	1006
Public Reserves on Norfolk Island	244.5
Nepean Island Reserve	10
Norfolk Island National Park	460
Norfolk Island Botanic Gardens	5.5
Phillip Island	190
Public roads, vacant Crown Lands	133
Total	**3,856**

Figure 2. Anson Bay © Carla Miles

INTRODUCTION & CONTEXT

Continued

Norfolk Island is a mountain top remnant of an elongated shield volcano and consists primarily of a large, elevated plateau, formed from horizontal sheets of basalt (NIRC 2018).

The climate is moderated by the ocean, with average temperatures of 13–19 degrees Celsius in winter and 18–25 degrees Celsius in summer. Annual rainfall averages 1312 mm with most rain falling in the winter.
The first known human activity on the island was by Polynesians who colonised the island more than 1000 years ago, bringing with them the Polynesian rat (Rattus exulans) and some edible plants.

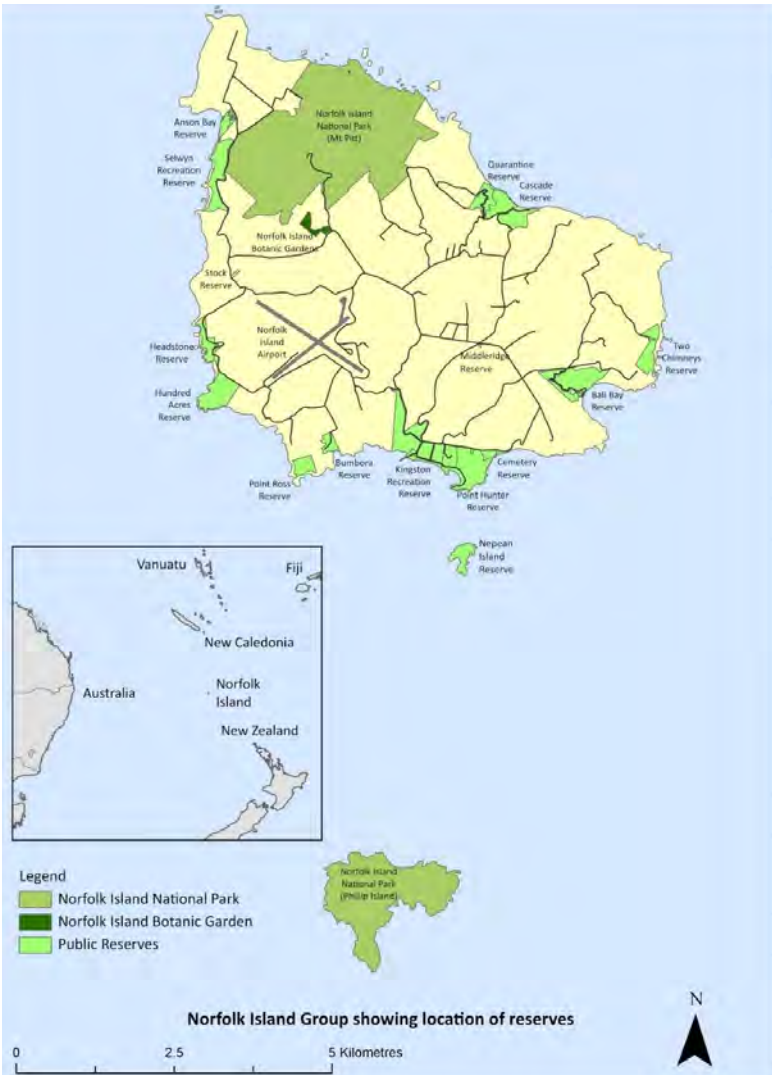


Figure 3. Norfolk Island National Park, Botanic Gardens and Public Reserves (source: Director of National Parks in prep.)

When Capitan Cook arrived in 1774, Norfolk Island was uninhabited and covered by dense forest. The British set up two penal colonies between 1788 and 1855.
The island is perhaps most famous for its connection to the Bounty Mutiny. In 1856, the entire population of Pitcairn Island, home to the descendants of the mutineers, relocated to Norfolk Island. Many of residents today can still trace their ancestry back to those original settlers. Currently, Norfolk Island has a population of around 2000 people with up to 30 000 visitors each year.
The most recent Australian Bureau of Statistics Census Data, from August 2016, recorded Norfolk Island's population at 1,748. There were 1080 private dwellings recorded on the island at the time, and an average of 2.2 persons in each household.

INTRODUCTION & CONTEXT

Continued

The median age of people in Norfolk Island in the 2016 Census was 49 years. Children aged 0–14 years made up 16.9 per cent of the population and people aged 65 years and over made up 23.8 percent of the population. In Norfolk Island, 34.5 per cent had participated in voluntary work during the last 12 months, and 80.8 per cent of the population having internet access from their dwelling.

The Norfolk Island Regional Council formally commenced on 1 July 2016. As a local government entity, the primary legislation which governs the Council is the Local Government Act 1993 (NSW) (NI). It is important to note that Norfolk Island is not a part of the State of New South Wales but rather an External Territory under the authority of the Commonwealth of Australia.The Norfolk Island Act 1979 (CTH) remains the primary Commonwealth law which governs Norfolk Island as an external territory of Australia. The Council is unique in that it provides a broad range of local government services to the community of Norfolk Island, as well as commercial services such as an international airport, telecommunications, electricity generation and distribution and a liquor bond.

Norfolk Island Regional Council delivers state-type services on behalf of the Commonwealth of Australia through a three-year Service Delivery Agreement (SDA) which commenced in July 2016. The SDA was extended until October 2021, with a new agreement reached between Council and the Commonwealth for the next 3 years. Council provides a number of environmental related services to the Commonwealth, including spatial and planning policy, public health and state-equivalent pest and noxious weed management.

Figure 4. The view from Mount Bates © Carla Miles

NORFOLK ISLAND REGIONAL COUNCIL STATE OF THE ENVIRONMENT REPORTING

This is the first State of the Environment (SoE) Report for Norfolk Island Regional Council.

The Local Government Act 1993 (NSW) (NI) requires the Norfolk Island Regional Council to produce a State of the Environment Report in the year in which an ordinary election of councillors is held (generally every four years) (NIRC 2018).

SoE reporting is an important management tool that aims to provide decision-makers and the community with information on the current condition of the environment and changes in the condition of the environment over time. Environmental indicators can help focus and rationalise environmental monitoring programs by drawing attention to the critical measures required to evaluate environmental trends and conditions (ANZECC 2000).

Indicators have a well-understood meaning and can be measured regularly and allow information about the environment to be communicated effectively. Environmental indicators are used to determine environmental trends and identify any events or activities that have a major impact on the environmental objectives in the Community Strategic Plan (CSP) (Norfolk Island Regional Council 2016) and the Environment Strategy (NIRC 2018).

The purpose of the first Norfolk Island SoE is to report against the indicators in the Environment Strategy. Data is gathered where available, trends are assessed and recommendations for further monitoring and long-term data collection are provided to improve and add value to future Norfolk Island State of the Environment Reports. Reporting against operational targets and actions associated with strategic objectives is beyond the scope of this report. This progress is captured in the NIRC Annual Reports.

The relationship between the environmental objectives of the Norfolk Island Community Strategic Plan 2016 and the six environmental themes from the Norfolk Island Environment Strategy 2018 is shown in Table 2.

The background information contained within this report for each of the six themes is summarised from the Norfolk Island Environment Strategy, NIRC Annual Reports between 2016-17 and 2019-20 and input from NIRC staff and partner organisations.

Table 2

Environmental Objectives in Community Strategic Plan	Environmental Themes from the Environment Strategy	Reference in Norfolk Island Environmental Strategy 2018
1. Use and manage our resources wisely	1. Energy, transport and resources	Tactics 1.1 and 1.4
	2. Waste	Tactic 1.3
	3. Sustainable food supply from the land and sea	Tactics 1.5 and 1.6
	4. Clean water in our tanks and marine	Tactics 1.2, 1.6 and 2.5
2. Preserve a healthy environment	5. Population, planning and retaining open landscapes	Tactics 2.1, 2.2 and 2.3
	6. Biodiversity	Tactics 2.3, 2.4 and 2.6

THEME 1
ENERGY, TRANSPORT, UTILITIES, AND RESOURCES

Image: Qantas Plane landing at NI Airport © NIRC

THEME 1 ENERGY, TRANSPORT, UTILITIES, AND RESOURCES

Key Achievements

- Purchase and installation of three new Cummins Generators for the Powerhouse.
- Upgrade and reseal of Norfolk Island Airport runway and lighting systems.
- Installation of a new 3G/4G mobile network and softswitch.
- Development of a 20-year Airport Master Plan to manage future growth.
- Purchase and installation of a Desalination unit as part of wider strategy to improve water security.
- Tesla Megapack 1200kwh Battery Energy Storage System was purchased and installed on island to complement diesel generators, reducing diesel consumption for electricity by approximately 20% (estimated saving is 280 kL diesel per year on 1.4ML consumption). The project was successfully delivered in February 2021.

THEME 1

Continued

Background

Energy

Key energy infrastructure on Norfolk Island includes an old island-wide electricity network powered by diesel generators (Figure 5), individual solar hot water systems and solar power systems on some houses and businesses, and since February 2021, a new Tesla Megapack 1200kwh Battery Energy Storage System (Figure 6). On good days the solar generation in the 'diesel off' mode sometimes keeps the battery at the required level that diesel off mode is extended or the second generator is required only for a minimal time.

Diesel, petrol, LPG and other fuels are delivered to the island by a ship/tanker and stored in tanks at Ball Bay.

Electricity supply and distribution is an operational function of the Norfolk Island Regional Council. Council staff maintain the diesel generators and electricity distribution network according to management plans and work schedules.

Figure 5. Diesel generators © Alistair Innes-Walker

THEME 1

Continued

The cost of electricity to businesses and households on Norfolk Island is currently almost four times more expensive than on the Australian mainland. The diesel generators need to operate at a minimum of 30 per cent capacity and the grid is unable to handle additional power generated.

The island has around 1.4 megawatts of solar on 420 consumer rooftops. In 2013 a moratorium was put in place on the installation of household photovoltaic solar power systems and batteries due to the high penetration of rooftop solar PV (a high feed in tariff for rooftop Solar PV has resulted in an inequity between homes and businesses that have Solar PV and those that do not (Maurin et al. 2021). The aim was to have the moratorium lifted in 20/21, however this did not happen as the infrastructure to synchronise the network and an appropriate tariff pricing schedule were not in place. It is expected the moratorium will be lifted in 2021/22 and extra batteries may need to be installed before solar installs are permitted again.

Figure 6. Tesla Megapack Battery Energy Storage System © John Christian

THEME 1

Continued

In March 2020 Council made a decision to transition to 100% renewable energy by 2024 (NIRC Annual Report 2019-2020). A critical step in this process is the roll-out of smart meterage across all connected properties on island, so that solar power fed from properties can be regulated into the network. Voltage regulators are also required for this transition.

Until 2021 there was no central battery storage, and excess electricity generated from solar power systems was dispersed using a heater bank at peak solar generation times.

Approximately 90% of hot water installations over the reporting period have been solar systems. A local plumber commented on the apparent shift to install cheaper and more instant gas water systems especially for smaller dwellings. A rebate (small-scale technology certificates) is available to encourage the installations of solar hot water systems under a Federal Government operated scheme.

Image: Electrical Main Distribution Board © NIRC

THEME 1

Continued

Transport

Norfolk Island has 77.8 km of paved roads, which are generally in poor condition. The main modes of transport on Norfolk Island are small cars, motorbikes and small to medium trucks.

There is no public transport on the island, although a taxi service is currently in operation on the island.

In 2013, there were 2,365 registered vehicles (including hire cars) and a further 564 unregistered vehicles on the island. As of 30th June 2021, there were 2,654 registered vehicles. A small number of electric cars are present on Norfolk Island.

In their Norfolk Island Roads Audit and Strategy Report, Worley Parsons (2015) found 30 km of roads were rated as Condition 2 (urgent attention needed), with an estimated repair cost of $10–$15 million. There is currently very little rock available on the island and rock supply presents a major limitation for road maintenance.

During the period in which Boral Resources were on Norfolk Island to reseal the airport runway, the opportunity was taken in 2020 to utilise Boral's asphalt plant. Nine kilometers of road were able to be re-surfaced to a much higher than normal standard.

Image: Middlegate Road, 2022 © NIRC

THEME 1

Continued

Timber supply

Ten years ago it was estimated that about half of the timber used on Norfolk Island was grown and processed locally, with the remainder imported from New Zealand (Byron 2012). Based on discussions with local timber suppliers, it is expected that approximately the same ratio between imported and locally produced timber exists. The local timber supply is limited almost exclusively to the endemic Norfolk Island Pine (Araucaria heterophylla).

In 2018 it was estimated (M Christian pers comm. in NIRC 2018) that approximately 50 trees were milled each year although Byron (2012) reported that approximately 80 trees were being milled each year.

While the only permanent mill on the island produces in the order of 600–1000 m3 of timber annually, this doesn't necessarily equate with sales due to the time required for milled timber to dry (NIRC 2018). Byron (2012) reported that approximately 1000 m3 of NZ radiata pine was being imported annually from New Zealand; about half of the estimated total consumption of sawn timber.

The taking of native trees is regulated under the Trees Act 1997 (NI) and requires that an authorised officer under the Act assesses the tree before it is taken for milling. The Act allows for the taking of pines that are dying (due to disease or age), or that pose an unacceptable risk to life or property.

Image: Norfolk Pines, Bumboras Beach © NIRC

THEME 1

Continued

The Trees Act 1997 (NI) also allows for the registration of timber plantations. Where a plantation is registered under the Act, the trees can be used for the purpose of milling for timber, even where they are a protected species under the Act. Byron (2012) reported that there were approximately 20 plantations registered under the Act. Over the period that this SoE Reports covers, no new plantations have been registered. There is now a source of Norfolk Island Pine and other native seedlings available through the Parks Australia nursery, for the purpose of conservation.

The historic 'Forestry Area' within the Norfolk Island National Park is another potential source of timber for Norfolk Island in the future. There are plans to remove the eucalypts (approximately 26ha) which pose a significant bushfire risk and rehabilitate the area with native species. The eucalypt timber was originally planted to supply public and private sectors with posts and poles and prevent the destruction and removal of natural timber, especially the Norfolk Island Pines. However, it is now predicted to be of little economic value owing to its over-mature age even for posts and poles, limited prospects of export and the price, performance, convenience, efficiency and ease of working with imported NZ radiata pine. Local wood users and builders simply prefer the safety and ease of working with radiata pine or Norfolk pine, and it hasn't been worth the time and effort to acquire the expertise, technology and equipment suitable for each eucalypt species for relatively small volumes of wood supply.

Byron suggested a phased removal of the eucalypt plantations, utilising any logs that are wanted for sawing or poles and chipping everything else, for either landscaping or as fuel for a high temperature incinerator at the WMC, a specially acquired supplementary power station or firewood.

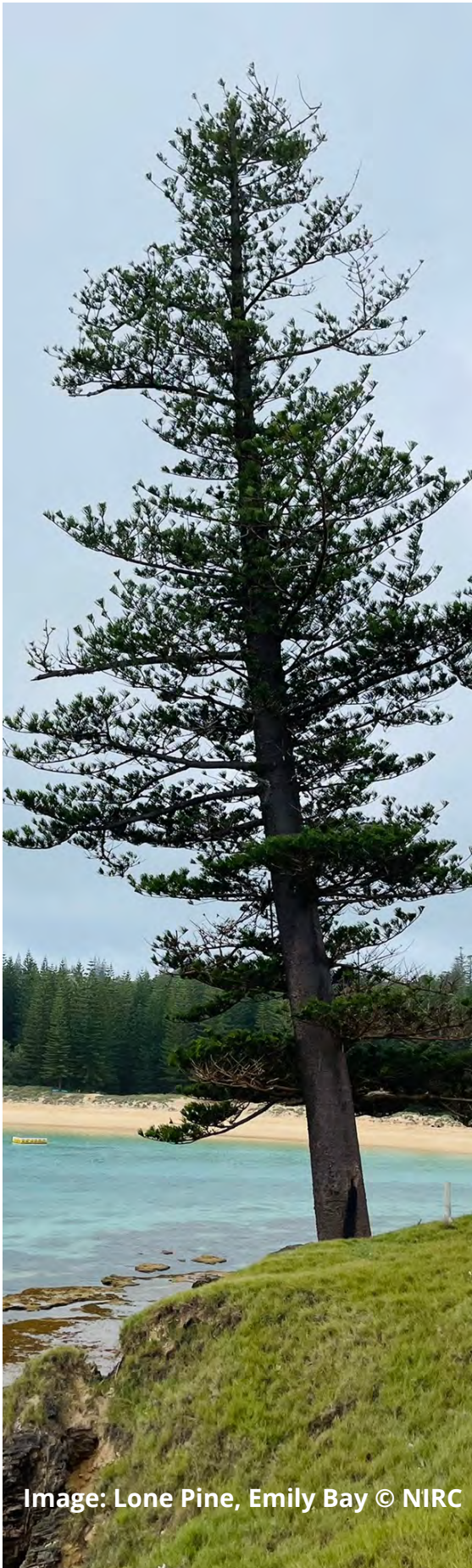


Image: Lone Pine, Emily Bay © NIRC

THEME 1 ENVIRONMENTAL TRENDS

Table 3 details the environmental indicators and available data for the five years prior to and including 2020-21 for Theme 1 – Energy, transport, utilities and resources.

Table 3. Indicators and data for theme 1: energy, transport utilities and resources (July 1 2016 – June 30 2021)

Indicator	16-17	17-18	18-19	19-20	20-21	TREND	Data Confidence (H, M, L)
Total electricity generated (kwh) Million	5.34	5.55	5.52	5.55	5.51	Stable	H
Average energy use per household (kwh)	unknown	unknown	unknown	unknown	unknown	Unknown	-
Average energy use per Council building (kwh)	unknown	unknown	unknown	unknown	unknown	Unknown	-
Number of solar hot water systems installed	unknown	unknown	unknown	unknown	unknown	Unknown	L
Number of additional vehicles registered/imported 1	441	359	319	340	376	Down then up	H
Total number of registered vehicles	2444	2564	2530	2485	2654	stable (up and down)	H
Number of electric cars imported	unknown	unknown	unknown	unknown	unknown	Unknown	-
Volume of diesel used in electricity generation (litres)	1,469,147	1,498,694	1,452,225	1,444,278	1,487,029	Stable (up and down)	H
Volume of diesel delivered (litres)	1,872,883	1,859,391	1,788,636	2,373,745	1,859,391	Stable (up and down)	H
Volume of petrol delivered (litres)	1,237,230	1,221,635	1,227,505	1,164,132	1,237,485	Stable	H
Volume of LPG delivered (taken from storage at Ball Bay) (litres).	511,634	456,123	477,693	431,932	412,026	Decreasing (except 2017/18)	H
New tree plantations registered under the Trees Act 1997 (NI) (number)	0	0	0	0	0	Stable	L
Amount of timber sourced for construction that is grown and harvested on Norfolk Island (m3) 2	unknown	unknown	unknown	unknown	unknown	Stable	L
Amount of timber imported to Norfolk Island (volume)	620	620	620	620	620	Stable	L

Footnotes - Table 3

1. Vehicle types registered (note -new registrations equate to those imported (Webb pers. comm.):
    a. Motor Cycles - Not For Hire
    b. Motor Cycles - For Hire
    c. Private Motor Vehicles
    d. Omnibuses
    e. Private Hire Vehicles
    f. Public Hire Vehicles
    g. Trailers/sidecars For Use On Motor Cycle
    h. Commercial Vehicles Less Than 1 Tonne Capacity
    i. Commercial Vehicles 1 Tonne or More Capacity
    j. Trailer - Less Than 1 Tonne Unladen Weight
    k. Trailers- 1 Tonne Or More Unladen Weight
    l. Motor Vehicles Not Normally Used On Road
    m. Oversized Busses (Do Not Register)
    n. Pensioner - Private Vehicle
    o. Pensioner - Private Motorbike
    p. Transfer Restrictions
    q. Veteran, Vintage, Historic
    r. Dealer Plates
    s. Vehicles Temporarily Offroad
    t. Administration Vehicles
2. The annual volumes are based on average volumes provided by the two main timber importers to the island over the reporting period

THEME 1 RECOMMENDATIONS

Table 4 Changes to Indicators

Indicator change	Reason	Action (change, remove or add)	Addressed in this Report (Y/N)
Revision: Use total vehicle registrations, rather than distinguishing between light and heavy.	Motor vehicle registrations are subject to the categories determined under the Traffic Act and are recorded in NIRC's registration system. Data that can be extracted includes the total number of registered vehicles, unregistered vehicles and new registrations each year.	Change	Y
Revision: LPG taken from the storage at Ball Bay	The volume taken from the storage at Ball Bay is more indicative of use than the volume delivered to the island by ship.	Change	Y
New indicator: No. of rooftops with PV solar panels	While this has remained stable over the 5 years of this Report, it is predicted to increase once the moratorium on solar power is lifted.	Add	N
New indicator: add Tonnes of rock sold on the island	To understand the supply and demand of local rock. This requires the development of a process for collecting data and liaise with suppliers of rock.	Add	N

Data collection

- Energy use – ensure internal systems allow for measurement of per household and Council building, as well as commercial buildings (which would be an additional indicator). Data on residences and previous work to formulate the waste charge may assist.

- Timber harvested and imported – establish a process to better record what is grown and harvested locally versus imported.

- Solar power – imbed a process to track changes in the number of photovoltaic solar power systems on the island, in anticipation of the moratorium being lifted in the near future.

- Registered tree plantations – remind the community of the need to register new tree plantations and imbed an internal process/procedure to record these registrations under the Trees Act 1997 (NI). Attempts in 2021 to obtain data on the number of registered plantations revealed there is no known location/register for this at NIRC.

THEME 2
WASTE

Image: NIRC Waste Management Facility© NIRC

THEME 2 WASTE

Key Achievements

- In 2018 Council was successful in obtaining funding to undertake an Environmental Assessment, to inform the development of a population policy (Maurin et al. 2021).
- In 2018 the Environment Strategy 2018-2023 was completed.
- In October 2018, a multi-purpose baler and mini sort line was commissioned to efficiently process household waste, cans, plastics, paper and cardboard, enabling Council to sort household waste for recovery of recyclable waste streams that compacts and straps bales for export and disposal.
- In 2018-19, an estimated 75% of municipal solid waste was diverted (not burnt and pushed into the ocean) from the Headstone Disposal Centre.
- In 2018/19 a full audit of sanitary facilities in KAHVA was undertaken and septic tanks were sealed and converted to holding tanks with alarms in 2021. Plans are in place to phase out septic tanks across the island as Development Applications are assessed. This will be done through updates to Development Control Plan 2 – Water Resources.
- In 2019 a business case for the upgrade of the Wastewater Treatment Plant was developed (Balmoral Group 2019) and further recommendation made by Bligh Tanner (2020).
- In 2020 a review of the Waste Management System was undertaken (Maurin et al. 2021)
- In 2021 a community-driven waste reduction challenge saw an uptake in residents and businesses taking action to reduce their waste. Plans for a resource recovery centre are underway by the community and Council. NIRC received funding through the Australian Government's Our Marine Parks Grants program to undertake a multimedia education and empowerment campaign, community survey and workshop.The development of the Norfolk Wave campaign followed to unite the Norfolk Island community to eliminate ocean disposal of solid waste. The vision statement of Miekduu, Mainaut, Miekhies - Be Resourceful, Mindful and Act Now! Join the Norfolk Wave Campaign and help keep our marine truly pristine is a call to action for each person who lives on or visits the island. This campaign aims to combine the deep connectedness between the Norfolk Island people and their love of their homeland with a sustainable vision for the future, where better waste choices are the norm.

THEME 2

Continued

Background

Waste Management Strategic Plan

The remote location of Norfolk Island restricts access to waste disposal and recycling facilities. The small size of the island means that landfill is not a feasible option, and the cost of managing waste is significant when compared to Australia.

Waste generated from packaging of imported goods contributes significantly to the volume of waste managed on Norfolk Island. Most fresh produce available on the Island is grown locally, which results in less transport and packaging and therefore less waste. However, recent times have seen a heavy reliance on internet shopping for basic supplies. This is mainly driven by the cost of supplies and availability due to limited ships. This has significantly increased the volume of packaging that is received at the Waste Management Centre (WMC).

The Norfolk Island WMC opened in October 2003 and is comprised of the Main Shed with a drop off zone, revolve area and processing area. As there is no waste collection service on the Island residents and businesses are responsible for dropping off sorted waste to the WMC. Solid waste is received, sorted and where possible, processed at the Centre. (Maurin et al. 2021)

Figure 7. The multi-purpose baler was a significant factor in improving waste management on Norfolk Island (© PJ Wilson)

THEME 2

Continued

Income from ticket sales from the WMC has reduced over te last four years from $124,704 in 2017/18 to $58,455 in 2020/21, which is concerning. The cause of this significant reduction is worth investigating further, e.g. is it possible that there is an increase in rubbish being burnt by residents/businesses rather than being taken to the WMC?

In 2020 Marine Plastic Solutions Pty Ltd was commissioned to undertake a review of the waste management system (Maurin et al. 2021). This involved a review of services and systems, a household waste audit, marine litter surveys and a brand audit.

A review of the Waste Management Strategic Plan is scheduled for 2021/22, including recommendations to reduce the export requirements for waste and seeking on-island solutions for recyclable waste streams. A review of cost recovery mechanisms is also scheduled, including appropriate levying of goods coming to island.

Image: Baled Waste from the multi-purpose baler © NIRC

THEME 2

Continued

Glass

A Glass Aggregates Systems crusher unit with a surge hopper attachment was in operation until 2019, but is no longer functional. The crushed glass was available for free to the public for use as an aggregate alternative for driveways, paths, pipe laying and bedding for water tanks.

All glass is currently deposited directly into the ocean.

The local soft drink company had a deposit scheme in place to reclaim and reuse glass beverage containers, but this business is no longer in operation.

Image: NIRC Waste Facility © NIRC

THEME 2

Continued

Composting

A 'HotRot' composting system (Figure 8) was installed in early 2020. After repairs (to the front-end loader) that took 12-months, it now manages all the organic waste streams on Norfolk Island, including livestock carcasses, food scraps, butchers' waste, cardboard and paper, green waste and untreated timber. Approximately 90% of the butcher's waste and animal carcasses and all of the food scraps are processed through the HotRot composting system. Before that, butcher's waste and food scraps, after being burnt, went straight off the chute into the sea. The remaining 10% of butcher's waste and animal carcasses are still dumped into the sea at Headstone due to local concerns that sharks will attack humans if this practice stops.

Most cardboard is currently shipped off Island, and even with the composter running at capacity most will still be shipped off Island as only a percentage can be put through the composter. The waste audit found that cardboard was the largest single municipal waste stream.

A 25-litre high-temperature incinerator, which is located at the Sewerage Treatment Plant, is used to dispose of biosecurity and clinical waste.

Figure 8. The 'HotRot' Composting System © NIRC

THEME 2

Continued

Asbestos

Norfolk Island Regional Council commissioned a barge to deliver goods to Norfolk Island and take waste back to Brisbane in mid-2020. Due to damage sustained to the barge during large swell, asbestos was unable to be taken back to the mainland for appropriate disposal. All legacy asbestos (more than 100 tonnes) was exported on the final Boral barge in December 2020. It is not currently known what volume of asbestos remains on-island in buildings and other structures.

Cars, tyres and other bulky waste

In 2018, it was estimated that around 1100 tyres were delivered to the WMC annually. Tyres are shredded and placed into used intermediate bulk containers or boxes and exported to Australia for recycling. As at the time of this report, there were approximately 300m3 of shredded tyres awaiting export. 4WD tyres cannot be shredded and were once burnt at Headstone. These are now stockpiled until a solution can be found. In 2020, a metal and car baler/crusher arrived on Norfolk Island, and this is capable of compressing items such as sheet metal, car bodies, bike frames, bulky furniture and white goods into small “blocks” ready for export.

Chemicals

The WMC currently accepts all types of chemicals, including oils and lead acid batteries. A 10 IBC capacity AS 1940-2004 compliant dangerous goods cabinet was installed at the WMC in July 2018. Batteries have been collected since December 2020 and at the time of this report there was approximately 25 tonnes awaiting export.

Other waste

Printer cartridges are sent to Planet Ark, but due to Norfolk Island’s remote location Norfolk Island Regional Council covers the cost of exporting printer cartridges to Brisbane where collection is free. E-waste is exported via airfreight on a semi-regular basis.

Image: stockpiled baled waste awaiting export © NIRC

THEME 2

Continued

Residual waste is the second largest component of municipal waste on the island; an estimated 151 tonnes (Maurin et al. 2021). Food waste was found to be the biggest component.

Backlog of waste

Although the majority of waste was exported with the Boral barge, there remains a backlog of stored of about 12 containers of waste awaiting export (at the time of this Report). Many of these materials (including batteries and chemicals) were to be exported to Brisbane on the Council-commissioned barge in mid-2020 but other arrangements need to be made following the barge mishap in mid-2020.

Headstone Disposal Centre

Until late November 2021, commercial loads of bulky waste and builders waste were delivered directly to Headstone Disposal Centre for burning and dumping into the ocean. All glass, hard/uncompactable plastics, and some steel products that continued to be incorrectly disposed of by the community at Headstone were dumped into the ocean after burning at the Headstone Disposal Centre. At the time of the waste audit in December 2020, the 70% (414 tonnes) of waste unable to be exported was made up of glass and cardboard (which was not being processed at that time) and mixed uncompactable waste from business and households (mainly construction wastes). This was transported to Headstone where it was burnt and an estimated 29% (170 tonnes) of ash and noncombustibles (mostly glass, metal, unburnt residues) remaining was disposed of into the sea. (Maurin et al. 2021).

There has been no systematic record-keeping of the amount or type of waste dumped into the ocean at the Headstone Disposal Centre over the years. The above figures are estimates only, at a single point in time. Limited data on the number of truckloads of waste taken to Headstone in the years leading up to the closure of Headstone in 2021 show an alarming increase (Table 4).

New arrangements (at the time of writing this report) should see that all waste is baled or dealt with away from Headstone.

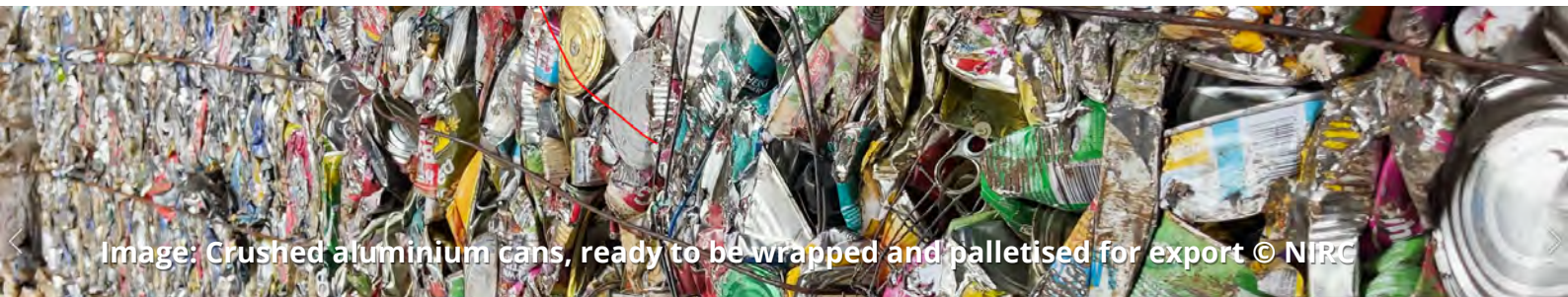


Image: Crushed aluminium cans, ready to be wrapped and palletised for export © NIRC

THEME 2

Continued

Compliance and complaints

Private dumping and incineration of waste is known to occur on the island. The 2020 community survey showed that the WMC services are not fully utilised by the entire population and there is a persistence of damaging practices of waste burning, burial and dumping (via Headstone). Many individuals choose to use the Waste Management Centre to dispose of only certain waste streams that they cannot easily burn on their properties such as glass. Others opt to boycott the Waste Management Centre entirely due to the required fees and misinformation about what is done with their waste once deposited at the centre. At home burning practices were found to be common with 45% of respondents indicating they burn materials such as cardboard/paper (35%), general waste (12%), green waste (12%), clean plastic (4%) and food and organics (2%). Waste burying practices are performed by 24% of respondent where 22% indicated they bury their food scraps and organics, 4% cardboard/paper and 2% green waste. (Maurin et al. 2021)

Complaints are dealt with in accordance with the Norfolk Island Regional Council Complaints Handling Policy. In most instances, the statute law under which such decision or action is taken will usually have a defined process for seeking review or, for appealing any decision or action taken. It is an offense under the Environment Act 1990 (NI) to emit smoke from your property if it is likely to impact on human health.

Formal complaints are rarely lodged. Verbal complaints are not recorded, but in the last year Council had received an increase in complaints from community members who are suffering the effects of toxic fumes. One written complaint was lodged in early 2021 regarding burning off by a hotel in the Burnt Pine township.

Image: Baled waste at NIRC Waste Facility © NIRC

THEME 2 ENVIRONMENTAL TRENDS

Table 5 details available data for indicators for the five years prior to and including 2020-21 for Theme 2 – Waste.

Table 5. Indicators and data for theme 2: waste (July 1 2016 – June 30 2021)

Indicator	16-17	17-18	18-19	19-20	20-21	TREND	Data Confidence (H, M, L)
Income through waste management fees/ticket system ($)[1]	0	124,704	114,181	69,686	58,455	Decreasing	M-H
Waste import levy income	$638,701	$513,891	$576,899	$560,227	$564,518	Up and down	H
Waste processed through the multipurpose baler (tonnes)	0	0	105.54	198.12	454.69	Increasing	M
E waste/white goods exported to Australia (tonnes)[2]	0	10.17	51.6	2.4	14.74	Up and down	M
Residual waste exported to Australia (tonnes)[3]	0	0	85.4	198.115	312.3	Increasing	M
Recyclable aluminium cans exported to Australia (tonnes)	0	0	6.17	0	5.87	Up and down	M
Recyclable steel cans exported to Australia (tonnes)			8.94	0	8	Up and down	M
PET plastic exported to Australia (tonnes)	0	0	5.03	0	10.5	Increasing	M
Recyclable shredded rubber exported to Australia (tonnes)	10	14.45	23.86	0	0	Increasing	M
Waste dumped in the sea at Headstone (no. of truck deliveries)[4,5]	unknown	unknown	243	382	442	Increase	L
Volume of waste composted at Waste Management Centre (cubic metres or tonnes).[6]	0	0	0	0	0	Stable	H
Volume of glass crushed at Waste Management Centre (cubic metres or tonnes)	0	0	0	0	0	Stable	
Volume of Asbestos exported (tonnes)	0	0	0	0	117.4	No progress until 2020/21	M
Volume of waste oils exported (tonnes)	0	0	0	0	74	No progress until 2020/22	M
Volume of chemicals exported (tonnes)	0	0	0	0	8.6	No progress until 2020/23	M
Volume of batteries/ferrous & non-ferrous metal exported (tonnes)[7]	0	35.94	69	0	0	Up then down	M
Volume of cardboard exported (tonnes)	0	0	0	0	12.17	No progress until 2020/23	M
Number of compliance notices for illegal dumping[8]	0	1	1	0	0	Stable	M
Number of official complaints about backyard burning of green waste[9]	0	0	0	0	1	Stable	L-M

Footnotes - Table 5

1. Tickets started in 2017/18.
2. Whitegoods were not exported every year (e.g. 2020/21 does not include white goods. E-waste only.)
3. Data for 19-20 stops at 24/4/2020, and does not include categories other than residual and E-waste. Due to budgetary constraints no more exports occurred during this time. All were stockpiled for the barge, which went out Dec 2020 (including 69.3t from 19/20)
4. See below table with trucks delivered to Headstone. Note we only started recording this from Jan 2019. There has been no record of the amount or type of waste dumped into the ocean at the Headstone Disposal Centre over the years. The above figures are estimates only.
5. For 2019/20, 414 t taken to headstone (170 t ash/non-combustible)
6. There were small amounts composted over the years but the composter has only become functional at the time of producing this Report. A future report could also consider capturing the amount sold in future
7. Includes copper, steel, aluminium
8. These were 2 formal compliance orders issued. One for burying asbestos and the other for dumping concrete wash water on the road. There were 2 warning letters issued in 18/19. One for dumping rubbish in the headstone reserve and another in Bumbora Reserve. They just weren't formal compliance orders.
9. There was one written complaint in early 2021 that lead to a nuisance abatement notice being issued to a hotel in Burnt Pine. Verbal complaints were received but not recorded.
10. General footnote - figures may be lower in 17/18 as not much started being exported until the island got regular freighters and some waste items did not start being exported until 2020/21. Some waste was produced in 2019/20 but is yet to be exported (in containers following barge incident).

THEME 2 RECOMMENDATIONS

Table 6. Changes to Indicators

Indicator change	Reason	Action (change, remove or add)	Addressed in this Report (Y/N)
New indicator/s: Include data currently collected but not listed as indicators in the Environment Strategy (exports of Asbestos, waste oils, chemicals, cardboard, batteries).	This data is collected (even though they were not included as indicators in the Environment Strategy) and adds to the waste management picture.	Add	Y
New indicator: waste import levy.	This provides a more complete overview of income for the management of waste (to accompany waste tickets)	Add	Y
New indicator: volume of waste dumped into the sea at headstone.	This is a critical thing to know and monitor over time, however data was not recorded while this practice occurred on Norfolk Island. Some relevant data has been included for the reporting period. This relates to truck deliveries taken to Headstone for burning and pushing into the sea.	Add	Y (partially)
New indicator: measure the overall volume of waste dropped to the WMC for processing.	This will provide an accurate measurement of the island's waste generation over time and will assist in identifying the most appropriate methods for waste management into the future.	Add	N
New indicator: develop a way to assess the level of incineration and dumping of waste on private land.	This will inform targeted action to address this waste issue.	Add	N

Data collection

- As of November 2021, disposing of waste into the sea at Headstone Disposal centre will cease. Monitoring the implications (diversions) of this will be important, as will compliance.
- Record all complaints (verbal and written) made to the Environment and Waste team of NIRC.
- Develop a central/shared database where data is entered and can be viewed and used for multiple sources as a single point of truth.
- Undertake routine record-keeping (aligned to indicators) to assist with reviews such as this in the future. For example, recording the number of times recreational waters exceed guidelines .

Other

- Investigate the reasons behind the drop in WMC ticket sales over the life of this Report.
- Enforce breaches of the Environment Act 1990 (NI) to reduce harmful pollution for burning by landowners.
- Set targets for reducing waste based on priority measures in Table 5. These would be more specific than the overarching goals for waste management under the Norfolk Island Regional Council Delivery Program 2016–2020, and align with the targets in the Waste Management Strategic Plan.

THEME 3
SUSTAINABLE FOOD SUPPLY FROM THE LAND AND SEA

Figure 9. A large range of fresh produce is grown on Norfolk Island
© Carla Miles

THEME 3 SUSTAINABLE FOOD SUPPLY FROM THE LAND AND SEA

Key Achievements

- An assessment was conducted on food security and the community's willingness to develop a more vibrant and diverse local food economy, as part of the Environmental Assessment conducted in 2020. This assessment identified a number of barriers to growth of the Norfolk Island food economy and the opportunities to expand local produce on island.

- Funding was obtained from the Commonwealth Government to complete a Food Security Strategy. This strategy will be developed in 2021-22.

THEME 3

Continued

Background

Agriculture

The agricultural industry on Norfolk Island provides the majority of fresh food consumed on the island and provides employment for locals and a financial contribution to the local economy.

Agricultural produce includes fish, vegetables, fruit, herbs, mushrooms, eggs, beef, pork, lamb, honey, nuts, milk and cheese (Figure 9). Many residents grow fruit and vegetables on their land for personal consumption, and there is a culture of bartering and sharing seasonal produce on the island.

Norfolk Island is home to a number of commercial food producers, including several larger market gardeners, graziers of cattle and sheep, pig owners, egg producers, beekeepers, a cow dairy, a goat dairy, and a number of smaller part-time and fledgling producers producing everything from duck meat and nuts to seasonal fruit, tea, coffee and herbs. Norfolk Island also has a number of commercial fishermen who supply all the restaurants, cafes, takeaways, residents and tourists. The following are the major commercial food producers on Norfolk Island:

- 4 major market gardens
- 1 mushroom producer
- 1 coffee producer
- 2 honey producers
- 1 pork producer
- 1 duck meat producer
- 2 egg producers
- 1 cow milk producer (who ceased to operate in April 2021)
- 1 goat milk (and other dairy products) producer
- Numerous commercial fishermen. (Maurin et al. 2021)

Image: Cows roam freely across Norfolk Island © NIRC

THEME 3

Continued

There are no major fruit producers on the Island, but rather numerous individuals, including the market gardeners and 'part-time backyard growers', who sporadically supply shops and roadside stands with excess fruit from their properties.

Norfolk Island has seen a progressive shift from a strong reliance on local food supplies to food sourced from an increasingly globalised food industry network. This shift has brought substantial benefits in the form of competitive pricing and access to a wider variety of food types. Yet some aspects of Norfolk Island's food system have become heavily reliant on external supplies, that is for a range of consumable goods as well as farm inputs such as fertilisers, pesticides and stock feed. This reliance on importation creates vulnerability of both residents and businesses affected by freight delays, increased charges and shortages of some products (Maurin et al. 2021). This context demands attention and the development of a considered approach to simultaneously ensure long-term food security for Norfolk Island and leverage the economic, social and environmental potential of an underdeveloped economic sector, the agri-food sector.

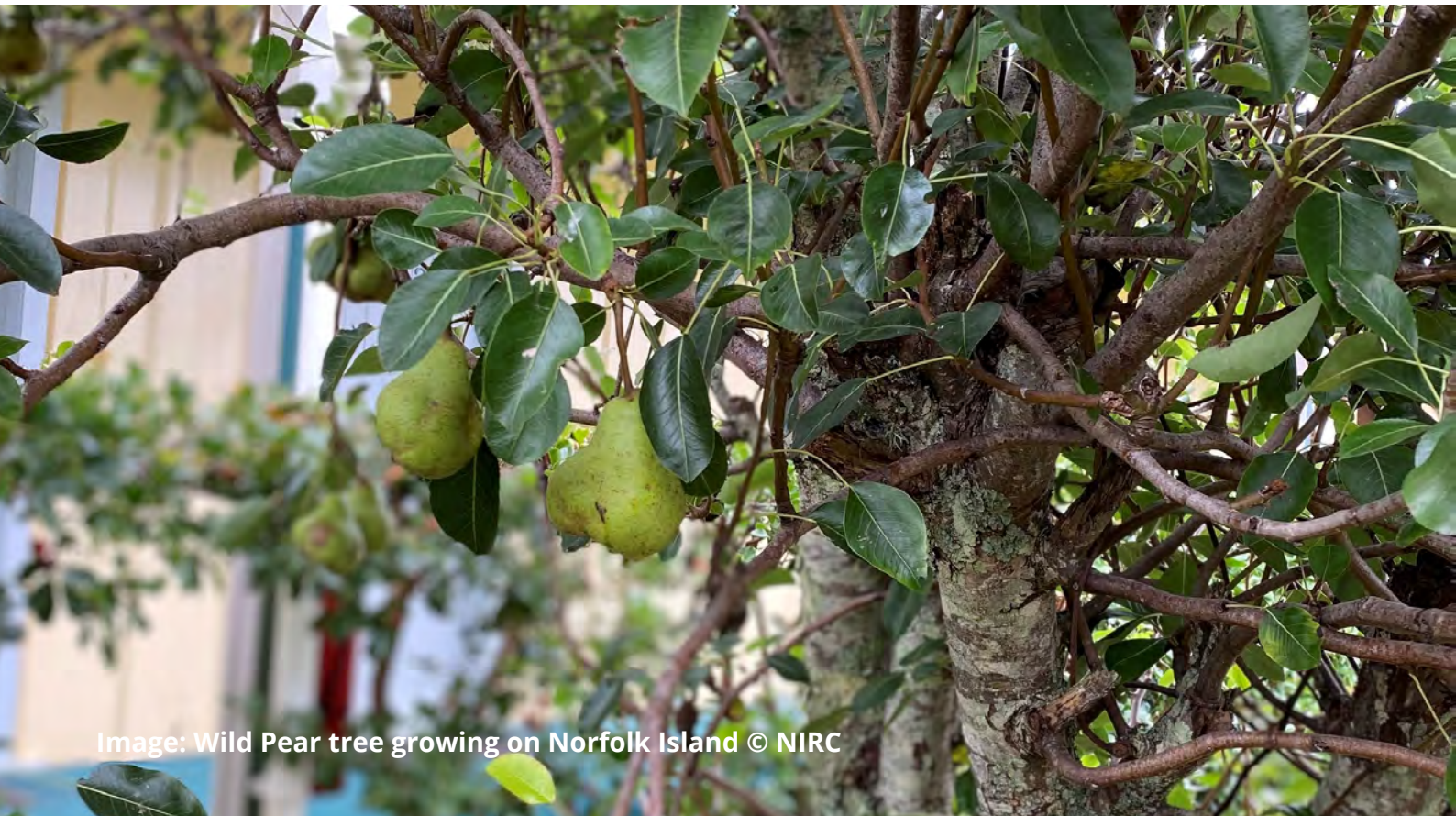


Image: Wild Pear tree growing on Norfolk Island © NIRC

THEME 3

Continued

The more significant freight issues which have been occurring over the past year have had major impacts on local food producers. For example, a major egg producer had to sell-off all their laying hens as there was no stock feed on the island with which to feed them. This has occurred twice in the past year. At various times, a total absence of fertiliser, certain herbicides, pesticides and stock feed on the Island has equally affected other producers. Food-related businesses have also been affected as they are unable to source essential ingredients. Cafes have been unable to sell coffee to tourists at times due to an absence of milk, for example. Some cafes and restaurants have had to close their businesses or operate on a reduced opening schedule. Norfolk Island's freight situation has become more problematic for residents and business owners in recent years, with closure of one of the two ships which previously serviced the Island. This has resulted in a reduction in surface freight of approximately two thirds, causing serious supply issues for local businesses. More air freighters have been scheduled in an attempt to make up a small fraction of the shortfall, however with this has come at increased costs compared to sea freight, and it remains uneconomical to airfreight heavier items like flour, sugar, rice, stock feed, and most building supplies (Maurin et al. 2021).

Surface and groundwater issues (quantity and quality) explained under Themes 2 and 4 also impact on the agriculture.

Image Roadside food stall © Norfolk Island Tourism

THEME 3

Continued

Biosecurity

The management of pests, diseases and pathogens that may impact the ongoing viability of food production on Norfolk Island is a very important issue to the Norfolk Island community.

Cargo vessels and regular passenger aircraft are the main human-assisted pathways for the introduction of pests, diseases and pathogens to Norfolk Island. Casual pathways such as irregular aircraft arrivals, cruise ships and itinerant yachts also pose significant threats to biosecurity.

Prior to July 2016, Norfolk Island was a self-governing external territory of Australia, and the government of Norfolk Island had full responsibility for biosecurity.
The Australian government (Department of Agriculture and Water and Environment) is now responsible for pre-border and border biosecurity under the Biosecurity Act 2015 (Cth) and the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (for live animal imports).

The Plant and Fruit Diseases Act 1959 (NI) and Animal (Importation) Act 1983 (NI) have not been repealed; however, the Biosecurity Act 2015 (Cth) overrides the provisions relating to biosecurity matters (Norfolk Island Regional Council 2018).

Until recently (2018), fresh food imports have been restricted to meat, eggs, dairy products, potatoes, onions, garlic, ginger and frozen fruit and vegetables. With changes to biosecurity arrangements in 2018, it is now possible to obtain a permit for the importation of a wider variety of fresh fruit, vegetables and cut flowers. Because of this, there are some concerns within the community about the risk of introducing associated pests, diseases and pathogens.

Image: Hawaiian Holly Weed © Sheldon Navie

THEME 3

Continued

Importation of Ruminants, horses and rootstock

The importation of live ruminants, such as cattle, goats and sheep, is no longer allowed under the Biosecurity (Prohibited and Conditionally Non-prohibited Goods—Norfolk Island) Determination 2016 (Cth).

Live horses can be imported from mainland Australia to Norfolk Island with few restrictions. Until recently, root stock was not allowed to be imported to Norfolk Island (permits are now available). Cuttings can be imported but are to be free from foliage and only first year growth is permitted.

Agricultural pests

There are many agricultural pests and diseases that have a negative impact on primary production on Norfolk Island. These include insect pests (for example Argentine Ants and Army Grub), weeds, rats, feral chickens and plant pathogens.

The primary pathway for many pests and animals to enter Norfolk Island is via materials imported via Australia and New Zealand. Occasionally new agricultural pests come to the island. Many unrecorded exotic species were detected during a quarantine survey in 2012-14, including the potato/tomato psyllid and South African mantis (Invasive Species Council 2017). In 2016/17 myrtle rust (Puccinia psidii),and palm seed borer (Coccotrypes dactyliperda) arrived. While the banana weevil was detected and identified in 2018, it was anecdotally reported and well accepted that this pest was already established and had been present on the island for possibly 10 years prior (pers comm. D Mietzel 2021). Surveys undertaken by Australian Government scientists visiting the island in February/March 2021 confirmed the presence of Phytophthora cinnamomi (including from re-examined samples from the quarantine survey from 2012–14). The fall armyworm (Spodoptera frugiperda) was also detected in 2021 (pers comm. D Mietzel 2021), as well the Inland Floodwater Mosquito which was detected in the Kingston Pier area in July 2021 and again in October 2021 (2021-22 Financial year).

Image: Argentine Ants on Norfolk Island © NIRC

THEME 3

Continued

Fishing

Fishing is a popular recreational activity on Norfolk Island (Figure 10 & 11)), and the Island relies heavily on marine resources as a source of food.

The coastal zone and marine waters around Norfolk Island are some of the most important assets on Norfolk Island. They provide habitat, visual amenity, recreational opportunities, and support the tourism and fishing industries.

Appropriate management of the marine ecosystem provides important benefits for the island's food security. Fisheries on Norfolk Island consist of an inshore/upper slope fishery and an exploratory offshore deep-water fishery.

The Norfolk Island Inshore Fishery Management Policy 2008 (FMP) was developed between the former Norfolk Island Government and the Australian Fisheries Management Authority (AFMA). A Memorandum of Understanding (MOU) was developed between the Norfolk Island Fishing Association and the former Norfolk Island Government, which aimed to implement the FMP developed in 2008. It is understood that the Norfolk Island Fishing Association is in the process of updating the MOU with AFMA.

The FMP is known locally as 'fishing inside the box', referring to the 'box' of 67 × 40 nautical miles around Norfolk Island.

The FMP is located within the Australian Fishing Zone (AFZ) and is designed to include all shelf waters around the island.

Figure 10 Fishing at NI
© Norfolk Island Tourism

THEME 3

Continued

Key points of the voluntary MOU are as follows.

1. That the MOU is limited to recreational and charter fishing activities in the waters surrounding Norfolk Island .
2. Commercial fishing is not considered in the MOU.
3. Norfolk Island residents are not required to hold a Commonwealth Concession while undertaking recreational and charter fishing within the “box”.
4. A catch limit of 45 kg of whole fish per boat per day, with a maximum of three bins per week of trumpeter during spawning season.
5. No more than 12 trumpeter measuring less than 250 mm in length per boat per day.
6. No trawling, long lining, net fishing, fish trapping and adherence to prohibited activities as per Part 2 of the Fisheries Management Act.
7. Protection of EPBC listed species, including reporting of interactions with protected species.
8. Reporting on catch size, effort, method, fish species, non-retained catch and other data.

The primary target species within the inshore fishery area is the red-throat emperor (Lethrinus miniatus), locally known as trumpeter. Other species caught include the bar cod (Epinephelus ergastularius), yellowtail kingfish (Seriola lalandi), red cod (Pseudophycis bachus) and snapper (Pagrus auratus).

Figure 11 Fishing at NI © Norfolk Island Tourism

THEME 3 ENVIRONMENTAL TRENDS

Table 7 details available data for indicators for the five years prior to and including 2020-21 for Theme 3 - Sustainable food supply from the land and sea.

Table 7. Indicators and data for theme 3: sustainable food supply from the land and sea (July 1 2016 – June 30 2021)

Indicator	16-17	17-18	18-19	19-20	20-21	TREND	Data Confidence (H, M, L)
Number of different food types (e.g. fresh fruit, vegetables, meats, jams) grown or produced locally /commercial. Yield?	unknown	unknown	unknown	unknown	unknown	unknown	L
Number of new agricultural pests (plants, animals, pathogens, diseases etc.) introduced[1]	2	0	1	0	2	Stable	L-M
Recreational fishing catch rate (tonnes)[2]	unknown	unknown	unknown	unknown	unknown	Unknown	-

Footnotes

1. 2016/17: 2 = Myrtle rust and Palm seed borer, 2018/19: 1= Banana Weevil (While the banana weevil was detected and identified in 2018, it was anecdotally reported and well accepted that this pest was already established and had been present on the island for possibly 10 years prior (pers comm. D Mietzel 2021)), 2020/21: 2 = Fall army worm (Spodoptera frugiperda) and Phytophthora cinnamomic (confirmed from past samples)
2. The President of the Fishing Association also advised there has been no overall data collection for the last two years but this data is kept by the individual commercial fisherman, with approximations made of recreational fishing take.

THEME 3 RECOMMENDATIONS

Table 8 Changes to indicators

Indicator change	Reason	Action (change, remove or add)	Addressed in this Report (Y/N)
Revised indicator – Potentially change number of food types to volume of food produced locally (or both). Limit to commercial food.	This is likely to be the most suitable measure that could be tracked over time, subject to water availability and reliability of freight).	Revise. Would rely on growers keeping records.	N
New indicator: Type and quantity of food imported to the island.	To assess ratio of local versus imported food.	Add. Would rely on importers keeping accurate records.	N
New indicator - Commercial fishing catch rate (tonnes)	To assess the whole picture of fish take, not just recreational.	Add	N

Data collection

- Liaise with the Fishing club to regarding improved data collection in the future, potentially as part of the MOU.
- Pests: Note – At the time of producing this report, The Department of Infrastructure, Transport, Regional Development and Communications commenced a Norfolk Island pest and disease survey, focused on bees, plants, the marine environment and terrestrial animals. These surveys will build on the 2012-2014 Quarantine survey (Maynard et al. 2018), updating data and filling gaps. This will be a key reference for future SoE Reporting on Norfolk Island.
- Develop a sustainable food strategy that includes suitable indicators and actions for relevant data collection.

THEME 4

CLEAN WATER IN OUR TANKS AND MARINE AREAS

Image: Crystal Pools, Norfolk Island © NIRC

THEME 4
CLEAN WATER IN OUR TANKS AND MARINE AREAS

Key Achievements

- More regular monitoring (since the appointment of the Health and Water Officer in 2019)
- Businesses started implementing requirements under the Public Health Act 2010 (NSW) (NI), e.g. UV filters and submitting water supply quality assurance plans.
- More community education and information on how to manage water quality (in tanks)
- Prior to the establishment of NIRC in 2016, there was no maintenance (and limited and inconsistent mapping) of sewer lines causing significant land-based pollution
- Initiation of livestock exclusion from waterways, and slight reduction in cattle numbers in these areas
- Septic tanks in KAVHA area were sealed and converted to holding tanks with alarms in 2021.
- 600,000 litres of emergency water produced through the Defence Force desalination plant

THEME 4

Continued

Background

Water Quality testing

Water quality issues on Norfolk Island were first recorded in the 1960s, when outbreaks of gastroenteritis led to concerns about the quality of the freshwater on the island. Assessments of some of the island's shallow groundwater wells were commissioned and the water was deemed unfit for human consumption due to high levels of faecal coliforms and nitrates.

Assessments in the 1980s revealed groundwater was contaminated with high levels of detergents, nitrates, chloride, faecal coliforms, and viruses, and it appeared that wastewater and livestock effluent was primarily responsible for the contamination.

Water quality sampling since this time has shown little improvement in water quality. Samples collected during water quality testing in Emily Bay (Figure 12) and Upper Cascade Creek Catchments continue to record levels of Escherichia coli above the adopted guideline values for human health impacts.

The frequency of water quality monitoring has increased since 2019 and more sites are being monitored. Potable water testing has been conducted at all private drinking water suppliers on the island including food outlets, water carters and visitor accommodation.

The recreational waters in KAHVA are monitored on a weekly basis over the bathing season focussing primarily on contaminants of concern to humans (e.g., E. Coli pathogens up to 2021, thereafter Enterococci).

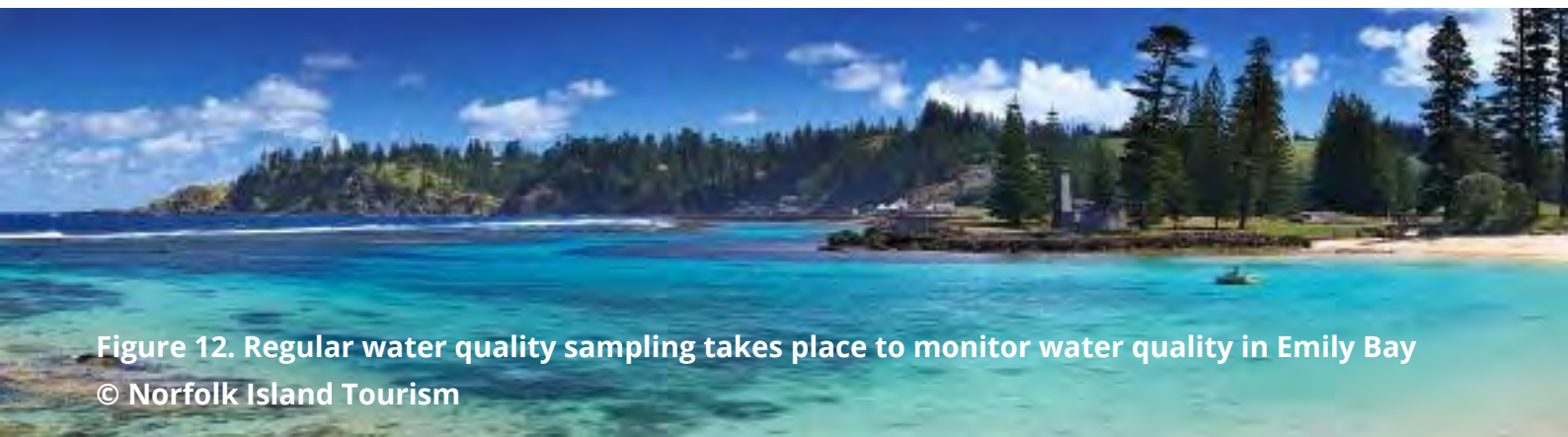


Figure 12. Regular water quality sampling takes place to monitor water quality in Emily Bay
© Norfolk Island Tourism

THEME 4

Continued

There are still substantial knowledge gaps in the status of the island's fresh and marine water quality.

In late 2020, Parks Australia commissioned a water engineering firm, Bligh Tanner, to investigate possible short-term options for preventing the entry of polluted surface water into Norfolk Marine Park at Emily and Slaughter Bay. The report examines various options and suggests that 'no regrets' measures like pumping out leaky septics and the construction of leaky weirs to slow the water could be explored.

At the same time, CSIRO commenced a water security investigation (Cuan et al. 2020), which has been extended to the end of June 2023 to include water quality. Under the ongoing water project, the Australian Government is funding CSIRO to:

- expand the Norfolk Island Water Resource Assessment monitoring program to include water quality data collection, monitoring, analysis and evaluation, in collaboration with Parks Australia and Norfolk Island Regional Council.
- undertake targeted water quality studies to improve the understanding of potential risks to marine water quality and inform development of catchment management innovations
- undertake an acid sulfate soils study, with these soils having significant impacts on aquatic ecosystems, infrastructure and agriculture.

Image: Water Quality Testing at Emily Bay © NIRC

THEME 4

Continued

PFAS

In December 2019, elevated levels of per-and poly-fluoroalkyl substances (PFAS) were detected in water samples from three sites on public land within the headwaters of the Mission Creek catchment directly below the aviation fire services training drill ground, adjacent to Norfolk Island International Airport (DITCRD 2021).

Per-and polyfluoroalkyl substances (PFAS) are manufactured chemicals used in a wide range of industrial and household applications globally. Some types of PFAS have been used in fire-fighting foams, particularly at places like airports, fuel storage facilities, and Defence bases, because they are very effective at extinguishing liquid fuel fires.

PFAS were also used across Australia and internationally in a range of common household products and specialty applications, including in the manufacture of non-stick cookware; fabric, furniture and carpet stain protection applications; food packaging and in some industrial processes. As a result, most people living in the developed world will have levels of PFAS in their body.

PFAS are emerging as a concern around the world because they are persistent and highly mobile in the environment. Currently there is limited evidence of significant impacts on human health from exposure to PFAS chemicals. Research in Australia and overseas continues to be undertaken.

Image: NIRC Fire Station located at the airport © NIRC

THEME 4

Continued

The three public facilities that were found to have concentrations of PFAS above adopted health guidelines now have alternative drinking water supplies. The supply of alternative drinking water will continue until the Detailed Site Investigation results become available. (DITRDC 2021)

The purpose of the preliminary site investigation initiated by DITCRD and undertaken by Senversa was to understand how groundwater may have been impacted by legacy fire-fighting foams containing PFAS, used as part of training activities. The scope of work included a two week on-island investigation undertaken in January 2020 to meet with the community and identify potential PFAS source areas; assess sensitive human and ecological receptors; and confirm key drinking water sources that should be assessed for PFAS impact. The targeted sampling undertaken included the collection of 172 samples consisting of 25 groundwater samples, 17 surface water samples, 41 sediment samples and 89 soil samples both on the airport and across the wider island. (Senversa 2021)

The information collected through targeted sampling and testing of local water bores will assist the Australian Government to understand the groundwater impacts and contribute to developing appropriate management strategies in relation to any potential human health and ecological risks.

Following completion of the investigation, Senversa and government representatives hosted community sessions in March 2021 and the Preliminary Site Investigation Report and fact sheets were released.

The PFAS National Environmental Management Plan (HEPA 2020) provides nationally agreed guidance on the management of PFAS contamination in the environment, including prevention of the spread of contamination. It supports collaborative action on PFAS by the Commonwealth, state and territory and local governments around Australia. This plan will support ongoing guidance and standards for managing PFAS contamination on Norfolk Island, to address water quality and security into the future.

Additional rainwater tanks for use by Council was identified as a high priority to avoid reliance of bore water that may be contaminated with PFAS, and water shortages under a drying climate. In 2021 NIRC was successful in a Building Better Regions Fund grant application to expand water storage.

THEME 4

Continued

Water quality in waterways

The island plateaus generally comprise dry valleys which lead into perennial and intermittent streams, which then discharge into one of the island's few primary creeks. Most streams are active only in the wetter winter months and are dry, or reduced to localised pools, in the drier summer months.

Past monitoring of surface water has indicated the presence of faecal coliforms, nitrates, viruses, chloride, ammonia, phosphates, heavy metals and pesticides above recommended guideline values.

The Norfolk Island Water Quality and Sewerage Infrastructure Management Strategy (ANI, 2014) identifies nutrient-laden surface water and catchment management issues as factors contributing to poor surface water quality.

The majority of Norfolk Island soils are well drained, clay-based soils with high plasticity, making them vulnerable to slippage. Slippage can lead to sedimentation and subsequent impacts on surface water quality, particularly following vegetation clearing.
Cattle grazing is having a major impact on water quality and biodiversity in the majority of waterways on Norfolk Island (Figure 13).

Water quality testing of freshwater resources around the island is conducted by NIRC Health staff. Historical water quality testing results have identified acidity issues within the lower reaches of the Headstone catchment. This has impacted water accessed for watering cattle. Work conducted by the CSIRO in 2020 (Cuan et al. 2020) confirmed the presence of Acid Sulphate Soils formed by peat-bearing material in the Headstone catchment, as well as other catchments on Norfolk Island.

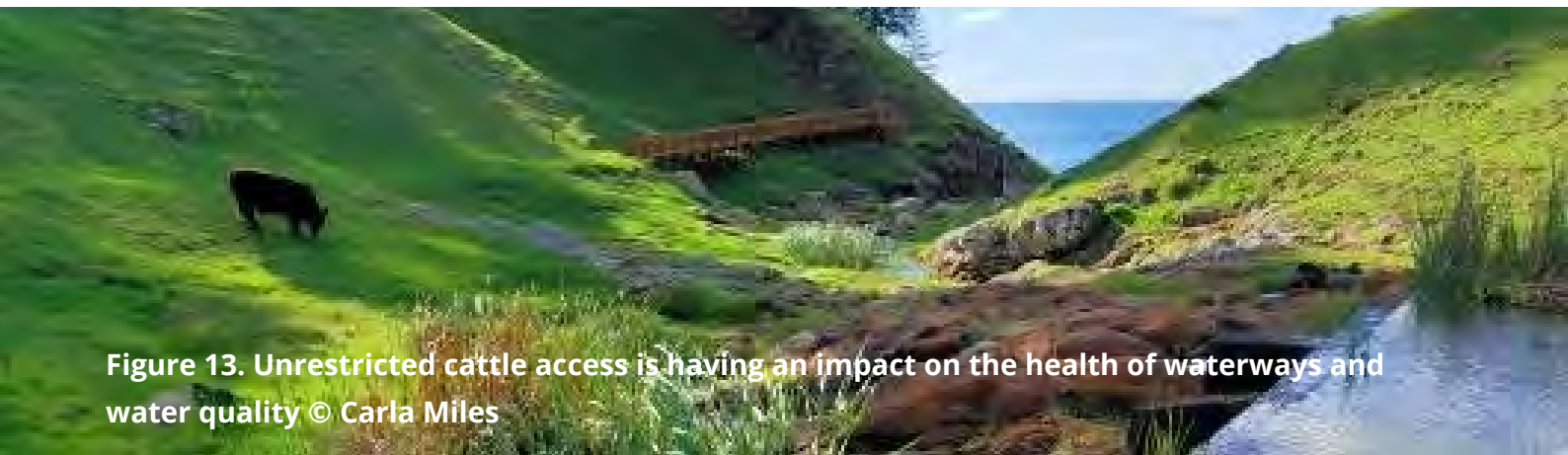


Figure 13. Unrestricted cattle access is having an impact on the health of waterways and water quality © Carla Miles

THEME 4

Continued

Groundwater

Groundwater aquifers and a large, sub-surface freshwater lens (a convex-shaped layer of fresh groundwater that floats above the denser saltwater) are thought to hold the majority of the island's freshwater.

There are two 'types' of groundwater aquifers known to occur on the island – shallow and deep aquifers. Shallow groundwater aquifers sit within the weathered mantle layer, typically on high-lying land.

Groundwater is used to supplement the island's rainwater and surface water supply. There are many groundwater bores across the island and some of these have been found to be contaminated, while others are dry or leaking. A moratorium on new bores has been in place since 1994.

Groundwater modelling by CSIRO shows significantly reduced standing water levels between 1976 and 2019 (Cuan et al. 2020) (Figure 14).

Figure 14 Northwest-Southeast section through island geological model, Cuan at al. 2020

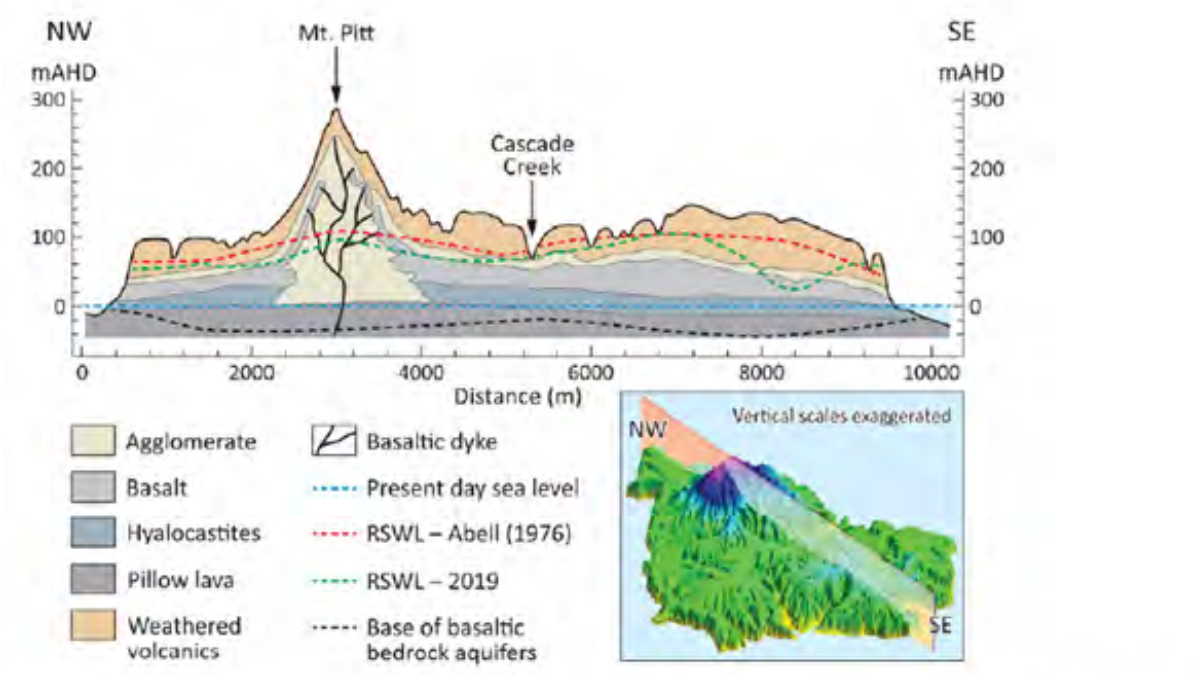


Figure 2 Hydrogeological cross-section including a comparison of reduced standing water level (RSWL) surfaces from 1976 and 2019

Bottom right inset is the location of the northwest–southeast slice through the geological model. Diagram based on data extracted from the geological model.

THEME 4

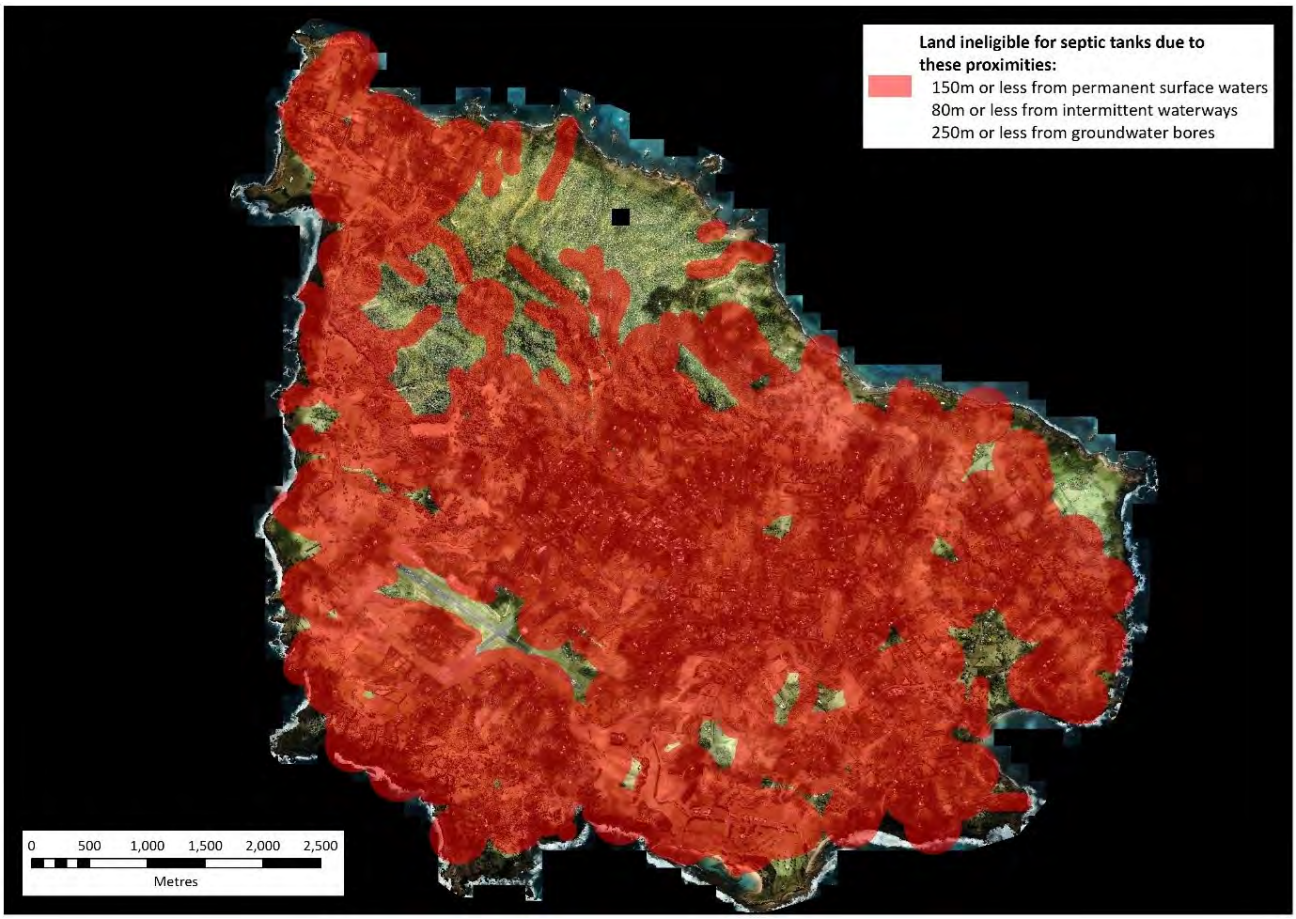
Continued

Sewerage Treatment

There are approximately 1000 on-site sewage systems on the island. Most of these are septic tanks, with a small number of on-site holding tanks or package treatment systems (the 2011 census concluded 79% of homes had septic tanks, 12% were on the sewer and the remaining did not say). There is no accurate information available about the number, location, condition or water quality impacts of on-site sewage systems. There was an audit of septic tanks in the KAVHA area in 2018, and these were subsequently sealed and soakage trenches cut off in 2021.

Disturbingly, based on NSW guidelines for septic tanks, most of Norfolk Island is not suitable for septic tanks because of potential proximity to permanent surface waters, intermittent waterways and groundwater bores (Figure 15). Septic tanks will be gradually phased out through updates to Development Control Plan 2 – Water Resources. However, this begins only with new development applications.

Figure 15 Land unsuitable for septic tanks on Norfolk Island



THEME 4

Continued

Development applications are subject to Council's Development Control Plan No 2. – Water Resources (DCP 2), which sets out water storage and effluent disposal requirements, water conservation standards and a duty to protect waterways. DCP 2 does not currently specify buffer distances between the sewage system and water bodies, or take into account the slope and soil conditions of the site. However, at the time of writing this report, a Rapid Assessment Guide was developed (and put out on public exhibition) to accompany an updated DCP once enacted. This details the buffer distances based on the type of system being installed.

A reticulated sewerage system known as the Water Assurance Scheme (WAS) is in place in and around Burnt Pine (the town centre). The WAS collects sewage from the serviced area (about 10 per cent of the residential population and most of the business sector in the CBD) and delivers it to the Sewerage Treatment Plant (STP) near the Airport. Sewage undergoes screening and minor primary and secondary treatment at the STP and is then discharged with all of the solids into the ocean at Headstone.

An assessment of the WAS in 2016 indicated issues with corrosion and the condition of the system. Most of the WAS system was inspected with a sewer camera in 2018 and there was no evidence of major leaks within the pipework. A number of leaking manholes have been upgraded in recent years to prevent future overflows.

The island's STP does not have any appropriate treatment for sludge and grit wastes and these wastes are pumped into the marine environment via the same outlet that receives the partially treated effluent. The STP does not currently have any return activated sludge (RAS), which it vital for replenishing microorganisms in the process.

Council's Development Control Plan No 2. – Water Resources (2011) states that 'developments within the area covered by the Water Assurance Scheme that generate sewage shall be connected to the Norfolk Island gravity sewer mains'. This requirement to connect to the WAS is only triggered when a development application is lodged. Where existing defective septic systems are found within the WAS area, it is recommended that further requirements for connection to the WAS be introduced. In addition, the WAS network is recommended to be extended to capture high-density development areas such as higher density housing in the upper KAVHA catchment (Wilson, 2017).

THEME 4

Continued

An application to the Building Better Regions Fund in early 2021 was unsuccessful because of the risk of low landowner uptake if voluntary, and the lengthy legislative changes required to mandate landowners to connect to the WAS network.

With the exception of the National Park and the public reserves, development is spread across much of the island. Therefore, a combination of a centralised (reticulated) system together with decentralised (on-site) sewage systems will continue to be needed into the future, although it is anticipated that there will be improvements in technology and maintenance requirements. This has been explored in the report Water Quality in the KAVHA Catchment (Norfolk Island Regional Council, 2017).

A framework for improving the existing Water Assurance Scheme in Burnt Pine and surrounds was first developed by Wilson in 2010. In 2019, Balmoral developed a business case for the upgrade of the island's sewerage treatment plan. Furthermore, Bligh Tanner (2020) presented a number of options and recommendations for the treatment of polluted water sources . The urgency of the issue has been identified by Parks Australia who have advised that the uncontrolled release of surface (and ground) waters into Emily Bay may cause irreversible damage to the coral reef. Figures 16 and 17 below illustrate the pressures on Emily Bay and management options presented by Bligh Tanner (2020).

THEME 4

Continued

Figure 16 Pressures on Emily Bay

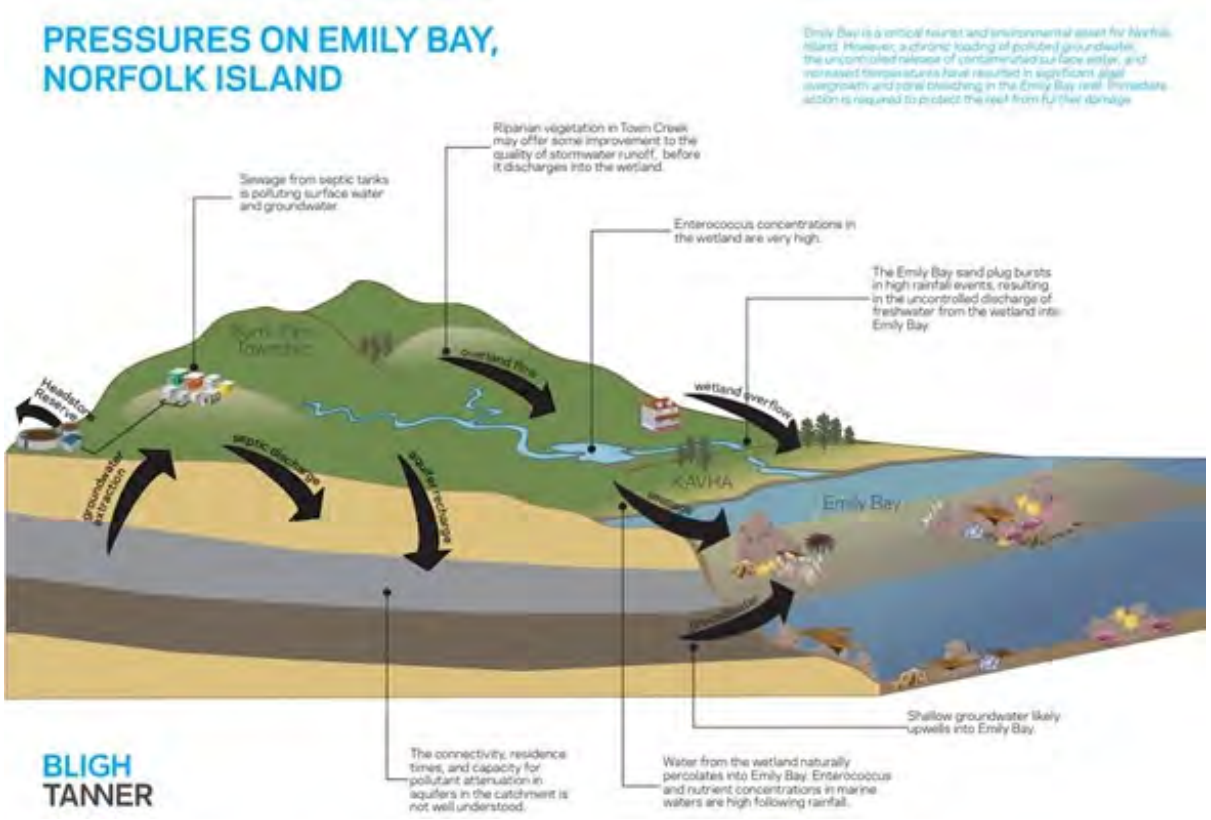
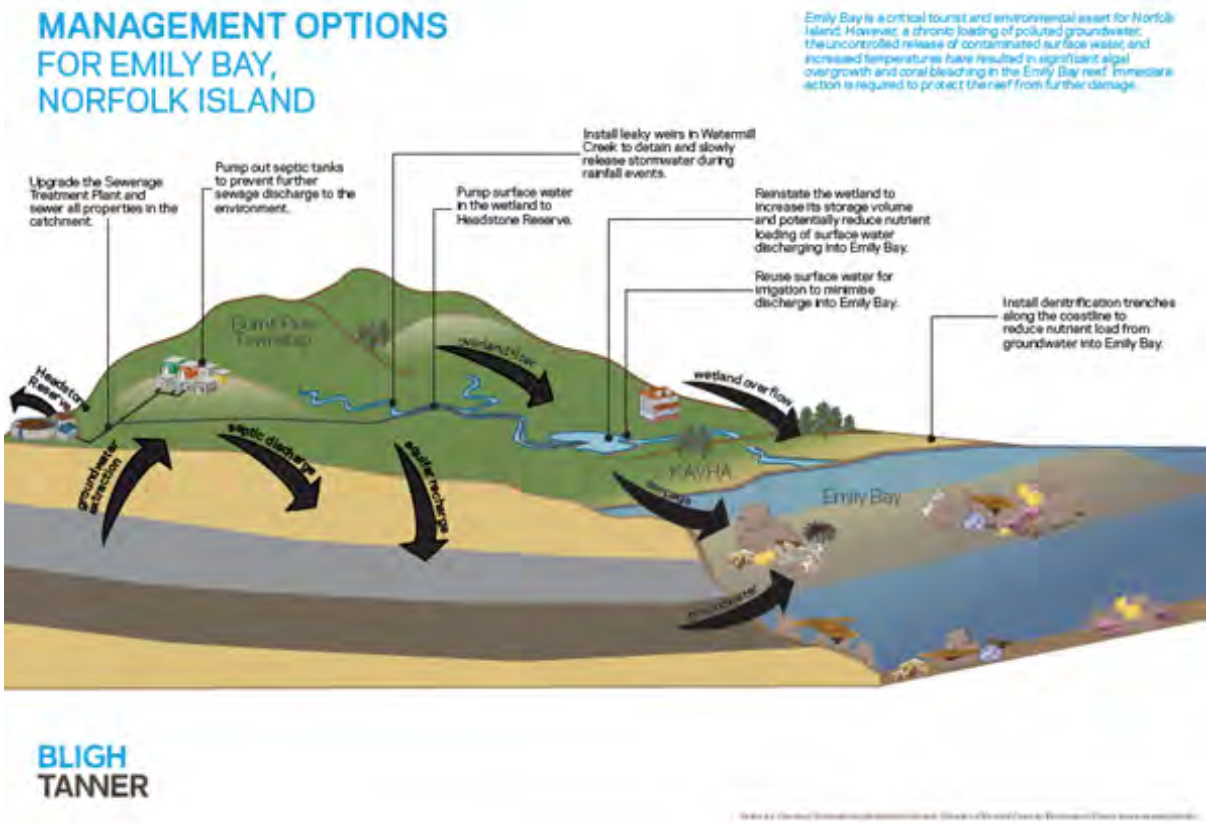


Figure 17 Management options for Emily Bay



THEME 4 ENVIRONMENTAL TRENDS

Table 9 details available data for indicators for the five years prior to and including 2020-21 for Theme 4 - Clean water in our tanks and marine areas.

Table 9. Indicators and data for theme 4: clean water in our tanks and marine areas (July 1 2016 – June 30 2021)

Indicator	16-17	17-18	18-19	19-20	20-21	TREND	Data Confidence (H, M, L)
Number of water-related breaches of Public Health Act 2010 (NSW) (NI)	unknown	unknown	84	79	64	Decreasing	M
(Percentage) of times water quality in freshwater streams results exceed Australian guidelines [1]	unknown	unknown	unknown	74.5	60.8	Decreasing	M
Number of times groundwater quality results exceed Australian guidelines[1]	unknown	unknown	unknown	unknown	unknown	unknown	-
Length of waterways cattle have direct access to (metres)	67,941	67,941	67,941	67,941	66,017	Decreasing	H
Percentage of times water discharged to the sea from the sewerage treatment plant exceeds water quality criteria detailed in licence conditions. imposed by the Department of Environment and Energy under the EPBC Act 1999 (Cth)	100	100	100	100	100	Stable	H
Number of sewerage overflow events (pump failures)	5	Unknown	0	0	3	Up and down	L-M
Number of upgrades to the sewer network including pump stations and waste water treatment plants	0	0	7	0	0	Stable	M
Number of non-compliant septic systems on Norfolk Island[2]	Unknown	Unknown	Unknown	Unknown	Unknown	Stable	L
No. of times recreational water quality results exceed Australian Guidelines (No. days Emily Bay exceeded safe conditions for human contact due to polluted stormwater intrusion)	Unknown/not measured	19	0	73	17	Up and down	L-M

Footnotes

1. NIRC does not monitor groundwater. The closest monitoring is that of that spring on the side of the road in KAVHA. All the other sampling sites are freshwater or marine water. PFAS was detected in 2019/20, but was likely to have been there in previous years.
2. Likely high non-compliance and ineligibility based on proximity to waterways (see Figure 13)

THEME 4 ENVIRONMENTAL TRENDS

Public Health Act 2020 breaches

Public Health Act 2010 breaches reported here include lack of chlorinators and unsuitable water chemistry , lack of a Quality Assurance Program and lack of a UV water filter at accommodation places and food premises. See table below. Note that the percentage of breaches is significantly lower when only the lack of UV water filters is considered, compared with when the QAP breach is included.

Table 10

Public health act 2010 pool breaches

Year	Inspections	no Chlorinator	water chemistry	total	%	% (UV only)
19-20	18	6	6	12	67	
20-21	24 [1]	4	10	14	58	

Public health act 2010 accommodation breaches

Year	total n businesses	QAP breach	UV breach	total	%	% (UV only)
18-19	83	52	7	59	71	8.4
19-20	76	45	7	52	68	9.2
20-21	72	29	8	37	51	11.1

Public health act 2010 QAP food breaches

Year	total n businesses	QAP breach	UV breach	total	%	% (UV only)
18-19	91	86	1	87	96	1.1
19-20	81	73	1	74	91	1.2
20-21	79	60	1	61	77	1.3

Summary

Year	Inspections	Breaches	% Breaches
18-19	174	146	84
19-20	175	138	79
20-21	175	112	64

THEME 4 ENVIRONMENTAL TRENDS

Water quality breaches – freshwater

Breaches were determined based on water quality testing in several freshwater locations where results exceeded Australian Guidelines. These are based on tables 3.3.2-3.3.3 of the ANZECC & ARMCANZ (2000) guidelines for south-east Australia (including Victoria, New South Wales, south-east Queensland, the Australian Capital Territory and Tasmania) for slightly disturbed ecosystems. The relevant parameters and acceptable levels are shown in the table below, followed by a summary of breaches from 2019/20 when testing began on Norfolk Island. Note – current work by CSIRO will hopefully determine Norfolk Island-specific trigger values which should be used to inform future SoE Reporting.

Table 11. Environmental Freshwater Water Quality

Site	Category	pH	EC	Turbidity	T Phos	Nitrate	Ammonia
Bloody bridge	Lowland river	6.5 - 8	0.125 - 2.2	Jun-50	0.05	0.04	0.02
Bumboras	Lowland river	6.5 - 8	0.125 - 2.2	Jun-50	0.05	0.04	0.02
Cockpit WF	Lowland river	6.5 - 8	0.125 - 2.2	Jun-50	0.05	0.04	0.02
Duck dam	Freshwater lakes and reservoirs	6.5 - 8	0.02 - 0.03	Jan-20	0.01	0.01	0.01
EB creek	Lowland river	6.5 - 8	0.125 - 2.2	Jun-50	0.05	0.04	0.02
Headstone raw	Freshwater lakes and reservoirs	6.5 - 8	0.02 - 0.03	Jan-20	0.01	0.01	0.01
Japs Bore	Groundwater - compare with Freshwater lakes and reservoirs	6.5 - 8	0.02 - 0.03	Jan-20	0.01	0.01	0.01
Japs Creek	upland river	6.5 - 7.5	0.03 - 0.35	Feb-25	0.02	0.015	0.013
KAVHA standpipe	Freshwater lakes and reservoirs	6.5 - 8	0.02 - 0.03	Jan-20	0.01	0.01	0.01
Mission pool	Freshwater lakes and reservoirs	6.5 - 8	0.02 - 0.03	Jan-20	0.01	0.01	0.01
Officers bath	Lowland river	6.5 - 8	0.125 - 2.2	Jun-50	0.05	0.04	0.02
Pony Club	Upland river	6.5 - 7.5	0.03 - 0.35	Feb-25	0.02	0.015	0.013

Summary

Year	Inspections	Breaches	% Breaches
19-20	146	196	74.5
20-21	101	166	60.8

THEME 4 RECOMMENDATIONS

Table 12 Changes to indicators

Indicator change	Reason	Action (change, remove or add)	Addressed in this Report (Y/N)
Breaches to be reported as percentages instead of numbers.	The total number of breaches has been increasing due to improvements in monitoring (more inspections and communications).Percentages of breaches provides a more accurate idea of progress.	Change measure ment	Y
Include more specific indicators where data collection is feasible.	Parameters may vary even further than summarised for this report, in particular for different uses of the water (e.g. primary contact recreation, irrigation for crops, livestock drinking water for livestock and human consumption).	Add	N
New indicator: Acid Sulfate Soils (ASS)-Percentage of times that pH in freshwater sites affected by ASS was below 5 (or 4.5 or limit to be advised)	ASS is an ongoing issue on Norfolk Island and its impact need to be monitored. ASS occur in many of the island's drainage lines, and acidify and change soil properties as they dry out (already occurring under climate change). This poses problems for new reservoirs, heritage structures and downstream environments.	Add	N
New marine water quality indicators: (using default ANZECC guidelines for SE Australia until Norfolk Island-specific guidelines are developed [reported as ug N/L rather than as ug NOx or NH4+ /L for comparison to these trigger values)**See Figure 18 below for relevant trigger values	Marine water quality not currently tested by NIRC. Marine Parks undertake testing when there is a high rainfall and stormwater runoff event.	Add	N
New indicator/s: Related to the marine environment (e.g. algal blooms, pest species and disease outbreaks, extent and condition of native habitats)	This theme is meant to cover the marine environment.	Add	N

THEME 4 RECOMMENDATIONS

Figure 18. Trigger Values Source: ANZECC & ARMCANZ (2000)

Tables 3.2.2–3.3.3 South-east Australia

The following tables outline default trigger values applicable to Victoria, New South Wales, south-east Queensland, the Australian Capital Territory and Tasmania. Where individual states or territories have developed their own regional guideline trigger values, those values should be used in preference to the default values provided below. (Upland streams are defined as those at >150 m altitude, while alpine streams are those at altitudes >1500 m.)

Table 3.2.2 Default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems. Trigger values are used to assess risk of adverse effects due to nutrients, biodegradable organic matter and pH in various ecosystem types. Data derived from trigger values supplied by Australian states and territories. Chl *a* = chlorophyll *a*, TP = total phosphorus, FRP = filterable reactive phosphate, TN = total nitrogen, NO_x = oxides of nitrogen, NH_4^+ = ammonium, DO = dissolved oxygen.

Ecosystem type	Chl *a* (µg L^{-1})	TP (µg P L^{-1})	FRP (µg P L^{-1})	TN (µg N L^{-1})	NO_x (µg N L^{-1})	NH_4^+ (µg N L^{-1})	DO (% saturation)[l]		pH	
							Lower limit	Upper limit	Lower limit	Upper limit
Upland river	na[a]	20[b]	15[g]	250[c]	15[h]	13[j]	90	110	6.5	7.5[m]
Lowland river[d]	5	50	20	500	40[o]	20	85	110	6.5	8.0
Freshwater lakes & Reservoirs	5[e]	10	5	350	10	10	90	110	6.5	8.0[m]
Wetlands	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
Estuaries[p]	4[f]	30	5[j]	300	15	15	80	110	7.0	8.5
Marine[p]	1[n]	25[n]	10	120	5[k]	15[k]	90	110	8.0	8.4

na = not applicable;
a = monitoring of periphyton and not phytoplankton biomass is recommended in upland rivers — values for periphyton biomass (mg Chl *a* m^{-2}) to be developed;
b = values are 30 µgL^{-1} for Qld rivers, 10 µgL^{-1} for Vic. alpine streams and 13 µgL^{-1} for Tas. rivers;
c = values are 100 µgL^{-1} for Vic. alpine streams and 480 µgL^{-1} for Tas. rivers;
d = values are 3 µgL^{-1} for Chl *a*, 25 µgL^{-1} for TP and 350 µgL^{-1} for TN for NSW & Vic. east flowing coastal rivers;
e = values are 3 µgL^{-1} for Tas. lakes;
f = value is 5 µgL^{-1} for Qld estuaries;
g = value is 5 µgL^{-1} for Vic. alpine streams and Tas. rivers;
h = value is 190 µgL^{-1} for Tas. rivers;
i = value is 10 µgL^{-1} for Qld. rivers;
j = value is 15 µgL^{-1} for Qld. estuaries;
k = values of 25 µgL^{-1} for NO_x and 20 µgL^{-1} for NH_4^+ for NSW are elevated due to frequent upwelling events;
l = dissolved oxygen values were derived from daytime measurements. Dissolved oxygen concentrations may vary diurnally and with depth. Monitoring programs should assess this potential variability (see Section 3.3.3.2);
m = values for NSW upland rivers are 6.5–8.0, for NSW lowland rivers 6.5–8.5, for humic rich Tas. lakes and rivers 4.0-6.5;
n = values are 20 µgL^{-1} for TP for offshore waters and 1.5 µgL^{-1} for Chl *a* for Qld inshore waters;
o = value is 60 µgL^{-1} for Qld rivers;
p = no data available for Tasmanian estuarine and marine waters. A precautionary approach should be adopted when applying default trigger values to these systems.

Data collection

- Identify the number and condition of on-site sewage systems across the island to better understand the impact they are having on the environment and appropriate management.
- Define (to be addressed by CSIRO) and use Norfolk Island specific trigger values for future water quality monitoring where available.

THEME 5
POPULATION, PLANNING AND RETAINING OPEN SPACES

Figure 19. Tree Ferns in Hundred Acres Reserve © Carla Miles

THEME 5 POPULATION, PLANNING AND RETAINING OPEN SPACES

Key Achievements

- Developed a strategy for the comprehensive 5 yearly review of the Norfolk Island Plan 2002
- Drafting Development Control Plan – 'Community Title' prepared
- Development Control Plan – 'Kingston and Arthurs Vale Historic Area' prepared
- Ongoing strategic planning for future rock supply for construction
- Contribution to development of NIRC 'Heritage and Culture Strategy', 'Environment Strategy', 'CSIRO Norfolk Island Water Resources Assessment Project'
- Facilitating initiation of 'Population Strategy'.

THEME 5

Continued

Background

Climate Change

The Southwest Pacific region is expected to experience a rise in air and sea temperature, sea level rise, variation in the amount and pattern of rainfall and changes in the frequency and intensity of extreme weather events such as cyclones and droughts. These trends indicate a shift in climate patterns that are likely to decrease available water, affect biodiversity and land productivity over the next 100 years (Maurin et al. 2021).

From Director of National Parks (in prep):

Current climate change projections for Norfolk Island include a 1.3°C increase in temperature (range, 1.1°C to 1.7°C) and a 6% decrease in rainfall (range, -13% to +4%) by 2050 (CSIRO, Managers of World Heritage Properties in Australia and Indigenous Reference Group 2021). More general regional climate change projections can be drawn from those for nearby Lord Howe Island which project increased frequency and severity of storm events, increase in drought events, drier winter and spring conditions, more intense marine heatwaves by mid-century (1.5–4 °C warmer with 240–320 days longer) and regional sea level change by 2046–65 of 0.2–0.4 m (Erwin et al. 2015; Bindoff et al. 2019; Oliver et al. 2019; CSIRO 2020). Drying trends observed on Norfolk Island are likely due to the extension of the poleward shift in the subtropical ridge which has influenced the decreased rainfall trend in south-eastern Australia (Cai 2011). The predicted impact of climate change on specific ecosystems is more uncertain. It is likely that climate change will have a profound influence on the distribution of vegetation, invertebrates and seabirds (Hughes 2003; Dunlop & Brown 2008; Director of National Parks 2011). This is exacerbated by ongoing significant reduction of tree cover.

Possible impacts of climate change on Norfolk Island include:

- decreased annual rainfall, changes in seasonal rainfall patterns, and long runs of dry years impacting on the hydrology of Norfolk Island and groundwater recharge and streamflow (CSIRO 2020);
- drying conditions and lower soil moisture balances affecting species requiring constant damp conditions to survive, such as species of montane cloud forests and certain invertebrates including insects and snails and the native flora;
- increased erosion and runoff due to increased intensity and frequency of storm events (particularly on Phillip Island until sufficient vegetation cover is achieved);
- increased temperatures resulting in heat stress in plants and an increased fire risk, which is of particular risk for many fire-sensitive plants and wet rainforest ecosystems; a site with particularly high fire risk is the forestry area, in which Eucalyptus trees are adjacent to native forest;
- increased sea surface temperatures and marine heatwaves which may impact regional marine communities and may have implications for top predators such as seabirds (Hyder Consulting 2008); and
- increased flooding, coastal erosion and saltwater intrusion in low lying areas (mostly Kingston) from more frequent and higher-level storm surges (Watkins Consulting 1999) in combination with sea level rise.

THEME 5

Continued

Population and Tourism

In 2016, Norfolk Island had a population of 1,748 people (ABS, 2016). Recent estimates by Emergency Management Norfolk Island (EMNI) were made to assist with planning for the COVID-19 vaccination roll-out. EMNI estimated the resident population to be 2,100 people. Planning staff at NIRC agree this would be a fair but somewhat overestimate based on data such as new housing, occupancies, people per dwelling and deregistered accommodation becoming places of residence. While the 2021 ABS Census data will provide a more accurate and current reflection of the island's population, other measures to understand the changing population of the island should be investigated.

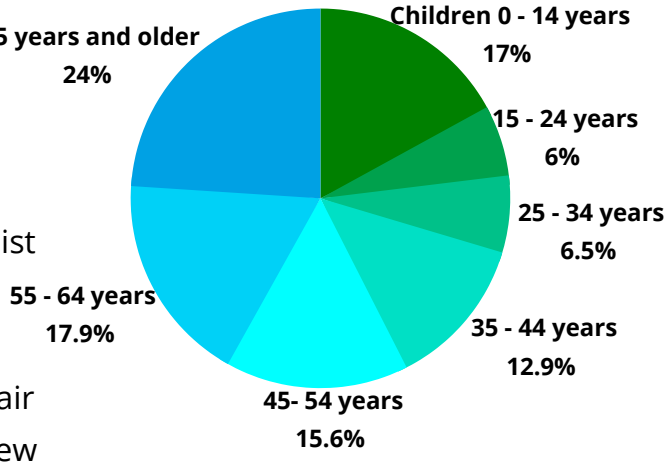


Figure 20. Population of Norfolk Island

The main industry is tourism, which generates up to 41 per cent of Norfolk Island's Gross Island Produce.

The Norfolk Island population can almost double due to the influx in visitors. While the number of visitors varies from year to year, the visitor population is an important consideration when planning for the future.

The Norfolk Island Tourism Strategic Plan 2012–2023 is designed to rebuild the tourism industry framework to provide for a greater level of self-reliance in five strategic themes, one of which is to is to increase visitor numbers arriving both by aircraft and cruise ship. This has far-reaching environmental implications for Norfolk Island. The 2019-2020 cruise season delivered a very small amount of cruise ship passenger numbers. Three cruise ships disembarked (total 3,238 pax) out of the ten ships scheduled for the year. The COVID-19 pandemic ceased all cruise ship arrivals from 17 March 2020 onwards.

If there is to be an increased resident and visitor population, planning for additional pressures on resources such as water, transport utilities and telecommunications infrastructure is essential. It is estimated (at the time of writing this report) there are currently around 1100 private dwellings on the island.

THEME 5

Continued

Telecommunications

Council is responsible for the provision of much of the telecommunications infrastructure on the island.

In 2020, Council upgraded the 2G mobile network to 4G (Figure 21). This now offers the benefit of mobile data for internet access as well as improved mobile phone service. Several new towers and associated infrastructure were installed across the Island as part of this upgrade.

The future proofing telecommunication Project was funded to the value of $3.45M through the Commonwealth Government's Building Better Regions Fund. The Council's contribution was budgeted to be $1.15M bringing the initial total project value to $4.6M. At 30 June 2020 71% of the Future Proofing project activities were completed, with installation of the mobile network infrastructure, and technical training, scheduled for completion by December 2021.

Internet

The NBN Co Satellite service has been available on Norfolk Island since 2019. This requires a small satellite dish to be erected at each receiving site, not large enough to trigger the requirement for a development application.

A 4G network was installed in 2020, providing residents and tourists the option to access data away from home, work or other WIFI locations such as cafes and accommodation.

Figure 21. Installation of the new 4G network commenced in 2020 © Alistair Innes-Walker

THEME 5

Continued

Open spaces – Norfolk Island National Park and Botanic Gardens

Two former reserves, Mt Pitt Reserve and Phillip Island, together form the Norfolk Island National Park, which was established under the Norfolk Island National Park and Norfolk Island Botanic Garden Act 1984 on 21 February 1984 and proclaimed under the Commonwealth National Parks and Wildlife Conservation Act 1975 on 30 January 1986.

The Norfolk Island National Park and Botanic Garden is now managed by Parks Australia in accordance with the Norfolk Island National Park and Norfolk Island Botanic Garden Management Plan 2020 (Director of National Parks 2020).

Open spaces – Public Reserves

There are 19 public reserves on Norfolk Island (Figure 4 and Table 8), covering an area of approximately 244.5 hectares.

Work to update Plans of Management for these Reserves commenced in 2019-20, and final 10-year Plans of Management are now completed for 10 Norfolk Island Regional Council Reserves (in bold below, Table 13). The update of the Plan of Management for Cascade Reserve commenced in 2020-21 and is scheduled to be updated in 2021/22.

All Norfolk Island Regional Council Reserves are managed in line with 10-year Plans of Management.

Norfolk Island Regional Council updated the Selwyn Reserve in

Figure 22. Tree Ferns in Hundred Acres Reserve © Carla Miles

THEME 5

Continued

2019/20, and is including Cascade Reserve in the Quarantine Reserve Plan of Management. A Plan has not yet been prepared for Nepean Island.

The KAVHA reserves in Column 3 are managed according to the KAVHA Heritage Plan of Management 2016, which guides the overall heritage management of the area. Instead of having individual plans of management for the KAVHA reserves, it is expected that a single Plan of Management will be prepared and used to specify the management of the significant natural values of these 6 reserves. Day to day operational work within the KAVHA Reserves, including mowing, issuing of camping permits and dog restriction enforcement will also need to be captured in this plan of management, as it is likely that such works will be the responsibility of Council.

Table 13. Public Reserves on Norfolk Island

Reserves transferred from the Commonwealth to the Norfolk Island Regional Council	Reserves yet to be transferred from the Commonwealth of Australia to the Norfolk Island Regional Council	KAVHA Reserves - to be retained by the Commonwealth of Australia
1. **Anson Bay** 2. **Ball Bay Reserve** 3. **Bumbora Reserve** 4. **Headstone Reserve** 5. **Hundred Acres Reserve** (Figures 21 & 22) 6. **Middleridge Reserve** 7. **Point Ross Reserve** 8. Quarantine Reserve 9. **Stock Reserve** 10. **Two Chimneys Reserve**	1. Nepean Island Reserve 2. **Selwyn Reserve** 3. Cascade Reserve	1. Cemetery Reserve 2. Government House Domain Reserve 3. Kingston Common Reserve 4. Kingston Recreational Reserve 5. Point Hunter Reserve 6. War Memorial Reserve

Figure 23. A rainforest track in the Norfolk Island National Park © Kevin Mills

THEME 5

Continued

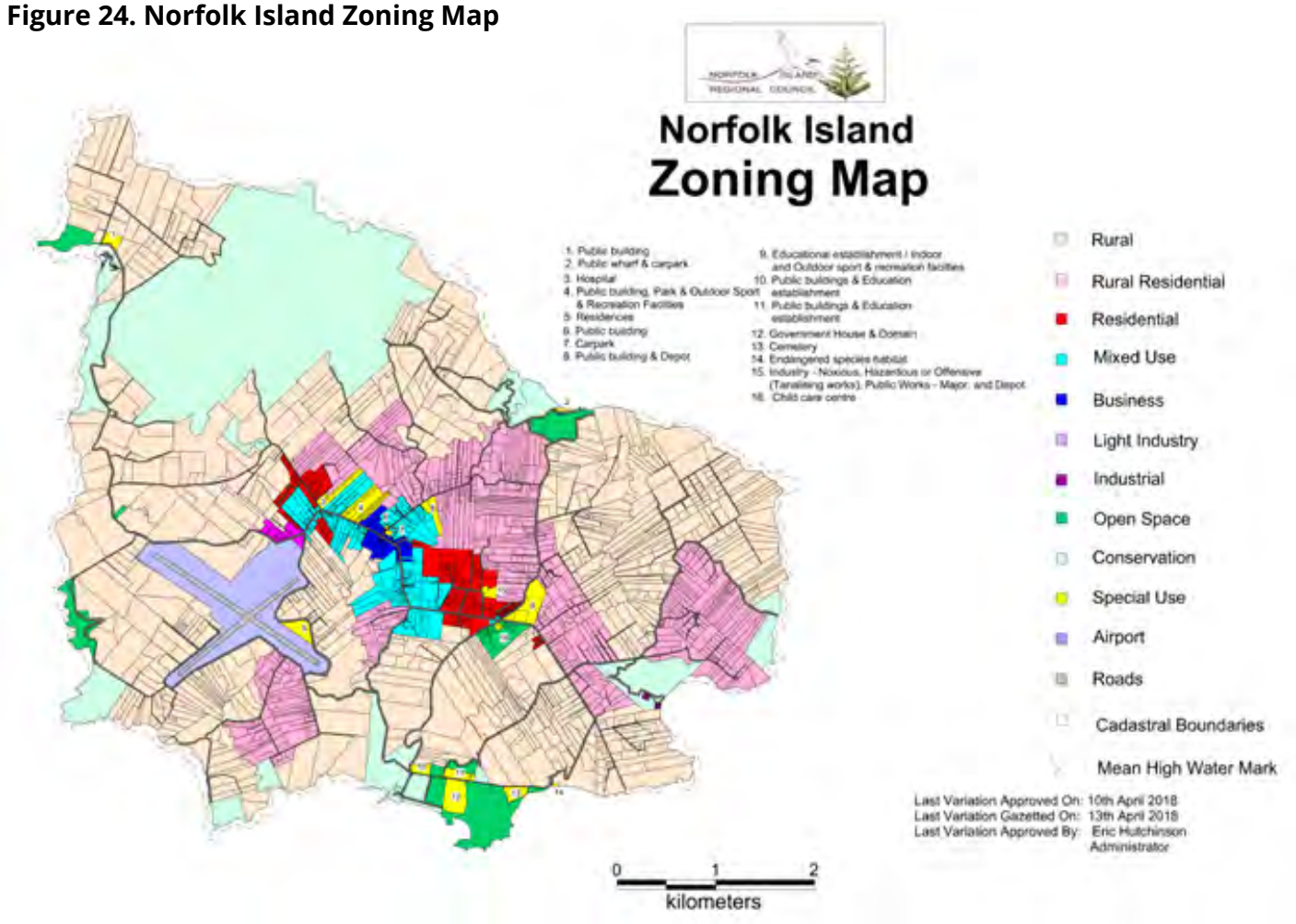
Open spaces – other public land

Examples of other public land include Kingfisher Paddock in the Anson Bay area, which is Crown land zoned rural. An area next to the school currently used for a rock stockpile is owned by the commonwealth and zoned Special Use – educational establishment and indoor/outdoor sports and recreation facilities. This site is planned to be used for community/public purposes in the future.

Other public land zoned for special use (public building, park, outdoor sport and recreation facilities) include the blocks of land around Rawson Hall including the football field, netball courts, skate bowl and playground.

The different zoning across the island is illustrated in Figure 24 below.
While zoning is unlikely to change significant across the island, there is always potential for increased use of open spaces by the public – for recreation and conservation.

Figure 24. Norfolk Island Zoning Map



THEME 5

Continued

Bike tracks and footpaths

Walking and cycling are one form of transport on Norfolk Island, but largely limited for travel to and from school. Norfolk Island has had limited sealed footpaths or bike tracks. However, in 2017/18 the network of paths was increased (by 917m) when a continuous path was installed alongside Queen Elizabeth Drive allowing school children better walking access from Burnt Pine to the school. In 2021 work commenced to install sealed footpaths from the airport to Burnt Pine town centre.

It is hoped that any future expansion of the path network will encourage more walking and cycling, and less driving of vehicles.

A network of 9.8km of off-road tracks are well maintained in the National Park and Botanic Garden. There are approximately 5.9km of walking trails across Council land, including public reserves, of which 4.7km is considered to be well maintained.

Figure 25. Bikes on Norfolk Island © Norfolk Island Tourism

THEME 5 ENVIRONMENTAL TRENDS

Table 14 details available data for indicators for the five years prior to and including 2020-21 for Theme 5 - Population, planning and retaining open spaces.

Table 14. Indicators and data for theme 5: population, planning and retaining open spaces (July 1 2016 – June 30 2021)

Indicator	16-17	17-18	18-19	19-20	20-21	TREND	Data Confidence (H, M, L)
Mean maximum temperature (degrees C)	24.3	24.1	24.1	23.9	23.8	stable, slight decrease	H
Mean minimum temperature (degrees C)	18.4	18.5	18.5	18.2	18.6	stable, slight decrease	H
Total rainfall (mm)[1]	814.8	1,085.80	920	842.2	1,107	Increase	H
Solar radiation	-	-	-	-	-	-	-
Average sea surface temperature (degrees C)	-	-	-	-	-	-	-
Number of Development and Building applications approved	56	71	54	60	91	Up and down, but overall increase	M-H
Number of new dwellings approved (private).[2]	6	7	10	6	6	Up and down but overall stable	M-H
Number of (net) new portions created by subdivision [3]	2	0	3	1	3	Up and down but overall stable	M-H
Total Population per annum[4]	1748	unknown	unknown	unknown	2100	Increase	L
Number of visitors/tourists per annum	29,732	28,363	26,096	20,295	19,382	Decrease	H
Area of land in the conservation zone (hectares) [5]	816.5	816.5	816.5	816.5	816.5	Stable	H
Area of land in the open space zone (hectares)	90.27	89.82	89.82	89.82	89.82	Stable, slight decrease	H
Additional length of bicycle paths or tracks (metres) installed	0	917	0	0	0	Increase	M-H
Length of off-road bicycle paths or [walking] tracks (metres) National Park & Botanic Gardens and Public Reserves [6]	9.8	9.8	9.8	9.8	9.8	Stable	M

Footnotes

1. Rainfall patterns per month would be a more nuanced indicator of the changing climate.
2. These are additional new dwellings excluding any alterations/renovations and additions and no subdivisions.
3. Total additional potions after subtracting any amalgamations, i.e. new portions with potential for additional development.
4. In 2016, Norfolk Island had a population of 1,748 people (ABS, 2016). A recent estimate of 2100 was made by Emergency Management Norfolk Island (EMNI) to assist with the COVID-19 vaccination roll-out. Planning staff at NIRC agree this would be a fair but somewhat overestimate based on data such as new housing, occupancies, people per dwelling and deregistered accommodation becoming places of residence.
5. Area of land in the conservation zone = Reserves zoned conservation 151ha, National Park Mt Pitt section 460ha; Phillip Island section 190 ha, Botanic Gardens 5.5ha, Nepean Island.
6. Off-road tracks – pertains only to the National Park and Botanic Garden

THEME 5 RECOMMENDATIONS

Table 15 Changes to indicators

Indicator change	Reason	Action (change, remove or add)	Addressed in this Report (Y/N)
Remove no. of households with telephone numbers and ADSL internet connections	Straight population estimate is more meaningful than such surrogate indicators.	Remove	Y
Show data for average rainfall on a monthly basis.	More meaningful than per annum.	Add	N
New indicator: No. of commercial/community/public dwellings	This would complement the no. of private dwellings	Add	N

Data collection

- Establish a reliable source of truth for the island's population.
- Ensure future SoE Reporting links to any indicators that may emerge as part of the population assessment/sustainable population strategy.

THEME 6

BIODIVERSITY

Image: Vegetable Garden, Norfolk Island © Norfolk Island Tourism

THEME 6

BIODIVERSITY

Key Achievements

- Morepork project (refer to Case study on page 106)
- Tree offset scheme drafted in 2020 (to be further developed in 2021/22)
- Plans of Management completed for 10 public reserves
- Pest Management Plan 2021-2026 developed and endorsed by Council
- Native plant nursery upgraded and expanded by Parks Australia and recovery of many threatened plants (see Appendix 1)
- Increases in two threatened bird populations; Norfolk Island Green Parrot and Kermadec Petrel (see Appendix 1)
- Native vegetation mapping project (Appendix 2)
- Waterway fencing initiated
- Partnership formed with community to support volunteerism. A Norfolk Island Conservation Volunteers group was formed in 2020 to assist in the management of invasive environmental weeds under the auspices of Norfolk Island Flora & Fauna Society Inc, supported by NIRC and the national park. In a short amount of time, the group who meet weekly have removed a vast area of coral berry (*Rivina humilis*) and other weeds.
- New roles including Senior Environmental Officer and Health and Water Officer (commenced 2019) and Environmental Project Officer (contractor) in 2020

THEME 6

Continued

Key Achievements (continued)

- Contract in place with CSIRO for Argentine Ant eradication
    - Argentine Ant eradication program on track (in 2019/20 zones 3, 5 and 10 and parts of zones 4 and 11 were baited from the ground and by the Frazer Drone). There has been a significant reduction in Argentine ant numbers within treated areas when compared to areas that have not been treated (NIRC Annual Report 2019-20).
- Major research including the Norfolk Island Environmental Assessment by Monash University and University of Newcastle (Maurin *et al*. 2021), and various projects in partnership with Parks Australia including assessing the impact of feral chooks and rats on native vegetation (University of Queensland), further research into the arboreal habits of rats (Monash University), research into the Green Parrot (Australian National University), and research and captive breeding of threatened snails (Australian Museum).

Native vegetation communities

Since the arrival of humans on Norfolk Island, clearing for agriculture, timber harvesting, cattle grazing and development has led to the fragmentation and loss of the majority of native vegetation on the island. Changes to other environmental factors such as hydrology, marine ecosystems and landform have also had a negative impact on the condition and extent of native vegetation on Norfolk Island.

Table 16 details the 14 native plant communities identified through the 2020 native vegetation mapping project and the key species that are found within each of the communities (Mills & Christian 2020; Invasive Species Council and TierraMar 2021). The maps of the 1750 and 2020 coverage of native vegetation in Appendix 2 highlight the significant reduction of many of the plant communities.

Image: Norfolk Pines at Captain Cook Lookout © NIRC

THEME 6

Continued

Background

Table 16. Native vegetation communities on Norfolk Island.

Native vegetation community	Key species
Moist Palm Gully Forest	*Rhopalostlyis baueri* (Nee-ow Palm), *Cyathea brownii* (Smooth Tree fern)
Moist Upland Hardwood Forest	*Dysoxylon bijugum* (Sharkwood), *Myrsine ralstoniae* (Beech), *Nestegis apetala* (Ironwood), *Pittosporum bracteolatum* (Native Oleander)
Pine Hardwood Ridge Forest	*Araucaria heterophylla* (Norfolk Pine), *Dysoxylon bijugum* (Sharkwood), *Myrsine ralstoniae* (Beech), *Nestegis apetala* (Ironwood), *Pittosporum bracteolatum* (Native Oleander)
Viny Hardwood Forest	*Celtis paniculata* (Whitewood), *Callerya australis* (Samson's Sinew), *Planchonella costata* (Bastard Ironwood), *Baloghia inophylla* (Bloodwood)
Plateau Hardwood Forest	*Elaeodendron curtipendula* (Maple), *Lagunaria patersonia* (White Oak) (Figure 15), *Nestegis apetala* (Ironwood), *Baloghia inophylla* (Bloodwood)
Lowland Valley Hardwood Forest	*Lagunaria patersonia* (White Oak), *Cyathea brownii* (Smooth Tree Fern), *Nestegis apetala* (Ironwood), *Baloghia inophylla* (Bloodwood), *Myrsine ralstoniae* (Beech) *Araucaria heterophylla* (Norfolk Pine)
Sheltered Coastal Forest	*Nestegis apetala* (Ironwood), *Myrsine ralstoniae* (Beech), *Baloghia inophylla* (Bloodwood), *Lagunaria patersonia* (White Oak)
Coastal Pine and White Oak Forest	*Araucaria heterophylla* (Norfolk Pine), *Lagunaria patersonia* (White Oak)
Coastal White Oak Shrubland	*Sporobolus virginicus* (Salt Couch), *Ipomoea pes-caprae* (Goats Foot), *Wollstonia biflora* (Mile-a-minute), *Ficinia nodosa* (Club Rush), *Spinifex hirsuta* (Coastal Spinifex)
Coastal Grassland	*Sporobolus virginicus* (Salt Couch), *Carpobrotus glaucescens* (Pigface), *Achyranthes aspera* (Chaff Flower, Coastal Achyranthes)
Moo-oo Sedgeland	*Cyperus lucidus* (Moo-oo), *Achyranthes aspera* (Chaff Flower, Coastal Achyranthes) *Carpobrotus glaucescens* (Pigface)
Coastal Flax Community	*Phormium tenax, Dianella intermedia, Coprosma bauera, Araucaria heterophylla emergent, Asplenium difforme*
Freshwater Swamp	*Schoenoplectus tabernaemontani* (Club Rush), *Typha orientalis* (Drain Flax), *Juncus continuus* (Bull Rush), *Eleocharis acuta* (Common Spikerush)

Image: Captain Cook Lookout © NIRC

THEME 6

Continued

Threatened flora and fauna

There are 46 flora species and 12 fauna species on Norfolk Island that are listed as threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*.

Appendix 1 details all threatened flora and fauna, their status and estimated population sizes in 2010 and 2020 (Director of National Parks in prep.). Of the 58 listed threatened species covered by the Norfolk Island Region Threatened Species Recovery Plan (2010; in prep.), 31 (53%) have seen increases in population size since the commencement of the 2010 recovery plan. The majority of these have been plant species (29).

A large proportion of the indigenous species on Norfolk and Phillip islands are endemic, including:

- 43 plants (almost a quarter of the native flora)
- 15 birds
- 3 marine fishes
- Hundreds of invertebrates, including an estimated 60+ land snails.

Figure 26. *Meryta latifolia* one of the recovering threatened flora on Norfolk Island © Kevin Mills

THEME 6

Continued

A number of other species (including the Lord Howe Island Gecko and Lord Howe Island skink) are restricted to the Norfolk Island and Lord Howe Island Group (Invasive Species Council and Island Conservation 2017).

Pest plants

Weeds on Norfolk Island are generally fast growing and require ongoing control due to the favourable climate. Without ongoing control, weed growth has the potential to significantly impact upon the natural values of the island through competition with native species, altering of microclimates, changing vegetation structure and reducing habitat quality.

There are almost twice as many introduced plants as indigenous plants on Norfolk Island (Figure 27), and some introduced plants have become serious weeds. With a few notable exceptions, much of the land outside of the National Park and some public reserves has been cleared of native forest. Unless this land is managed effectively it often becomes dominated by woody weed species including Hawaiian Holly, Red Guava and African Olive.

A list of principal and potential weed species in the context of biodiversity conservation is also available in the updated Threatened Species Recovery Plan for Norfolk Island (Director of National Parks in prep.)

Historical clearing of a large proportion of the native habitat on Norfolk Island has made the protection of remnant areas and the restoration of remnant vegetation critical.

Figure 27. Breakdown of indigenous and introduced (or naturalised) flora on Norfolk Island (Mills 2010)

Summary of the Norfolk Island Flora in terms of status and growth habit

Group	Indigenous	(%)	Naturalised	(%)
Trees	31	(17%)	37	(10%)
Shrubs	17	(9%)	42	(11%)
Vines/Creepers	19	(10%)	17	(5%)
Forbs	31	(17%)	206	(55%)
Grasses	15	(8%)	55	(15%)
Orchids	11	(6%)	-	-
Ferns	45	(25%)	6	(2%)
Sedges/Rushes	12	(7%)	12	(3%)
Total	**181**	**(100%)**	**375**	**(100%)**[1]

1. Varies due to rounding.

THEME 6

Continued

The Island has had a history of episodic rural development with native forests being cleared for agriculture and then abandoned: closure of the colonial penal settlements; unprofitable agricultural enterprises; decline in population during the world wars and periods of economic recession. In many areas, native forests have been replaced by extensive monocultures of woody trees and shrubs.

Invasive woody weeds such as African Olive, Porpieh or Red Guava (Figure 28), Hawaiian Holly and Hakea, often grow in dense, virtually impenetrable stands and exclude native plants. These stands provide a source of seed, which are then widely dispersed by both native and introduced birds, rats and cattle, making control difficult and expensive. Much of the land invaded by woody weeds is too steep for agriculture and is difficult to manage and rehabilitate.

Introduced weeds are a major threat to native flora and fauna on Norfolk Island. Plants that are not native to the Island degrade important and rare native vegetation communities and fauna habitat and compete with native species. They are a source of weed seeds and shelter weed seedlings that may then go unnoticed until they are too large to remove easily.

Figure 28. Red Guava or Porpieh can totally exclude native plants
© Carla Miles

THEME 6

Continued

There are significant direct and indirect economic costs of ongoing weed control. It is difficult to accurately estimate the annual cost of weed control on public and private land across the Island, but there is no doubt that the cost would be substantial. The impact on vegetation communities and habitat quality, and the impact on agricultural and horticultural productivity is also significant.

The Norfolk Island Regional Council roadside weed control program has targeted weeds such as Hawaiian Holly, Cascade Curse, African Olive, Lantana and Cascade Onion. Although of very little ecological benefit, this ongoing program to control weeds on roadsides has been successful and is a good local example of what can be achieved with planning and ongoing funding and resources.

The Norfolk Island Flora & Fauna Society has played a significant role in engaging the community in pest plant and animal control. The small group spent more than $20,000 on the Great Lily Hunt program over the last 5 years, aiming particularly at encouraging and financially rewarding removal of infestations on private property. The establishment of many billions of new plants has been averted via the program. As funding for the program is no longer available, it is important that authorities take control of its management to prevent it from spreading widely across the island, which it has the potential to do.

It is crucial that weed control programs are strategically planned and funded and follow up control and revegetation with appropriate native species (according to Norfolk Island native vegetation mapping) should occur where possible.

Future weed control programs on Norfolk Island should be implemented according to the Norfolk Island Regional Council Pest Management Plan (NIRC 2020), and the Plans of Management for Public Reserves.

THEME 6

Continued

Pest animals

Rats

Rats have also had a significant impact on the Island's flora by interrupting the dispersal and germination of seeds. For example, prior to the rat baiting program in the National Park, the endemic Bastard Oak (Ungeria floribunda) was reduced to widely scattered mature individuals, with few if any seedlings or young trees. However, a few years after rat baiting commenced, the germination of Bastard Oak seeds significantly increased in the vicinity of mature trees, suggesting that this species had been seriously affected by rats.

Eradication of the Black Rat from several New Zealand off-shore islands and other islands around the world, and the recovery of flora and fauna populations following these eradication programs, has demonstrated that this introduced species has had a devastating effect on native flora and fauna on islands.

In recognition of the devastating effect of introduced rats on native and endemic biota on islands, predation by exotic rats on Australian offshore islands of less than 1000 km2 (100,000 ha) has been listed as a key threatening process under the *EPBC Act 1999*.

The Polynesian Rat *Rattus exulans* was introduced to Norfolk Island by Polynesian settlers approximately 800 years ago and the Ship Rat or Black Rat Rattus *rattus* by Europeans, reportedly from the wreck of the MV *Ronaki* on Kingston reef during World War II.

It is likely that rats were a major cause of the extinction of many of the endemic terrestrial land snail species on Norfolk Island and perhaps in conjunction with cats, the two species of lizard that formerly occurred on Norfolk and are now only found on off-shore islets and Phillip Island.

The Black Rat has had a significant impact on Norfolk's biota, including the post-war extinction of the Black and White Sparrow and Guava Bird, and serious decline in other birds such as the Green Parrot, Norfolk Island Morepork, Pacific Robin and the White-breasted Silvereye, and the extinction of both species of bat (Gould's Wattled Bat and the Norfolk Island Free-tail Bat).

THEME 6

Continued

A well designed and funded rat control program is underway within the Norfolk Island National Park. Some targeted rat control currently occurs within Public Reserves on Norfolk Island, although funding is limited and rat bait stations are not re-baited as often as they should be and are empty for the majority of time. Rat control on private land is limited, patchy and uncoordinated.

Cats

Feral and free roaming domestic cats, which feed predominantly on vertebrate prey, are established and breeding in remnant native forest and weed infested areas throughout the Island.

Birds in fragmented habitats and ground nesting seabirds are particularly vulnerable to cat predation. In addition to taking a range of terrestrial birds, cats kill a significant number of breeding seabirds and their young, particularly burrow-nesting Ghostbirds, which are taken at night outside their burrows. Cats also have a large impact on vulnerable tree-nesting White-Capped Noddies and White Terns.

Feral and free roaming cats are having a significant impact on the fauna of Norfolk Island (Figure 29).

Figure 29. Free Roaming cats are having a significant impact on Norfolk Island fauna. These White Terns were found in Hundred Acres Reserve in early 2020.

THEME 6

Continued

Partly due to the presence of cats on Norfolk Island, the Scarlet Robin and Golden Whistler, which were once both quite common in gardens, are now largely restricted to the National Park (including the eucalypt forest), some public reserves and some native forest remnants on private land.

A 2007 study concluded that eradication of introduced vertebrate pests in the Norfolk Island group should be given a high priority, ranking Norfolk Island 11th highest among the world's islands.

Norfolk Island National Park staff undertake cat trapping in the National Park. For one month in October 2018 and October 2019, cameras were set up across the island to help predict island-wide abundance and movement of free-roaming cats. Results from this work were used to model the number of free-roaming cats across the island, which was estimated at 100 cats. This population figure is likely to be conservative and growing given the high number of domestic cats (approx. 500 on record at the local vet), potential breeding rates and current control efforts.

Norfolk Island Regional Council do some cat trapping within public reserves on Norfolk Island. Cat traps are available to private landholders, although this scheme has not been promoted widely in the past. The Norfolk Island Flora and Fauna Society and some private landholders also undertake cat trapping.

The current level of control of free-roaming cats by Norfolk Island National Park and Norfolk Island Regional Council is keeping a rapid population rise at bay - not seeing a decline in the population, but not seeing it get significantly worse. Any decline in control efforts, and/or an increase in domestic cats roaming and potentially breeding will cause the free-roaming cat population to increase dramatically, with dire consequences for wildlife. Specialists suggest that the feral cat population will remain stable unless a minimum of 70% of feral cats on Norfolk Island are removed on an annual basis (Lessa & Bergallo 2012; Speed pers comm. 2016).

THEME 6

Continued

An incentive program funded by the Australian Government was in place between September 2019 and June 2021. Cat owners could receive a subsidy of at least 50% to have their cat desexed and/or microchipped. Six set vet clinics held in Sept 19, Feb 20, May 20, Sep 20, March 21, June 21 resulted in 81 cats microchipped and 60 cats desexed (29 male, 31 female). Data on the number of cats desexed and microchipped over the relevant reporting period is presented in Table 12.

Alongside the incentive program a full information series on cat management was developed for the Norfolk Island community, funded by Parks Australia and the Threatened Species Commissioner. This was a direct response to a local community survey that was undertaken in 2017, which showed majority support for controlled cat ownership. A stronger regulatory response by Council is the obvious next step to seriously tackle the issue of free-roaming cats and their impact on biodiversity on Norfolk Island. This has also been identified in the Norfolk Island Regional Council Pest Management Plan (NIRC 2020) and the updated Threatened Species Recovery Plan (Director of National Parks in prep.) where the long-term vision is that Norfolk Island is free of invasive predator and competitor species—in particular rats, free-roaming cats, feral chickens, swamphens, crimson rosellas, Argentine ants and Asian house geckos. In the short to medium term the recovery plan is aiming for a 50% reduction in free-roaming cats.

Image: Free Roaming cats are having a significant impact on Norfolk Island fauna

THEME 6

Continued

Feral chickens

Feral chickens occur in most habitat types across Norfolk Island and are having a dramatic impact on the environment. Observations over many years suggest that feral chickens are changing the soil moisture regime through extensive disturbance of litter, reducing germination, disturbing seedling roots of native plants, and reducing the number of some invertebrates - including critically endangered land snails.

The culling of feral chickens in Norfolk Island Public Reserves does occur, although culling is currently prohibited for a one-month period between December and January and the feral chicken population does increase slightly during this time.

The population of Feral Chickens on Norfolk Island does fluctuate due to environmental factors, and it is uncertain if there has been any attempt in the past to estimate the population of feral chickens on the Island.

A targeted Feral Chicken eradication program in some Norfolk Island Public Reserves in late 2019 and early 2020 resulted in a noticeable reduction in feral chickens within targeted areas. A total of 728 feral chickens were culled from July 2019 and March 2020. Within days after culling programs were implemented, feral chickens from surrounding land moved back into reserves where targeted control was carried out, highlighting the need for continued feral chicken control across all land tenures.

Image: A bird nest low to the ground on Norfolk Island, © NIRC

THEME 6

Continued

Red parrot (Crimson Rosella)

The Red Parrot (Crimson Rosella) (*Platycercus elegans*) was introduced to Norfolk Island as a cage bird and is now widespread across the Island. The Crimson Rosella is in direct competition with native bird species such as the Norfolk Island Green Parrot and the Norfolk Island Morepork for territory and nesting sites (tree hollows).

The Crimson Rosella also eats similar foods to the Green Parrot, has similar nesting requirements and has also been known to break eggs and eject chicks from Green Parrot nests.

Although no research has been done to measure the impact of Red Parrots on endemic birds on Norfolk Island, it is highly likely that they are having a significant impact on the breeding success of species like the critically endangered Green Parrot and Norfolk Island Morepork.

The abundance or density of red parrots is currently unknown.

Some targeted Red parrot control has been undertaken around known breeding sites for the Norfolk Island Morepork and Green Parrot.

Tarler Bird (Australasian Swamphen)

A population of Australasian Swamphen (Tarler birds) (*Porphyrio melanotus*) has become established on Norfolk and Phillip Islands. The presence of the Tarler birds is believed to be impacting upon the breeding cycle of seabirds as a result of the swamphens destroying and eating eggs and killing young chicks.

Norfolk Island Regional Council and Norfolk Island National Park have permits for the control of 500 Tarler Birds over a five-year period across public and private land on Norfolk Island and on Phillip Island.

THEME 6

Continued

It is not known if there has been any attempt in the past to accurately estimate the population of Tarler Birds on Norfolk Island, but the current population on Norfolk and Phillip Islands is likely to be more than 500.

Norfolk Island National Park carry out regular planned control programs on Phillip Island and Norfolk Island Regional Council have assisted occasionally by undertaking Tarler Bird control on Norfolk Island, although this work could be better planned, resourced and coordinated. The NINP shooting regime that was implemented on Phillip Island in 2020/21 has led to breeding success of seabirds and should be maintained.

Other introduced birds

Introduced or self-introduced exotic birds have successfully established populations on Norfolk Island because they favour and are able to exploit the open grassland and mixed vegetation habitats created by human activities. Some, such as the Grey-breasted Silvereye and Blackbird are also at home in the forest.

The European Goldfinch plays a role in the dispersal of introduced thistles and other agricultural weeds and the Grey-breasted Silvereye is a pest in gardens and orchards and spreads the seeds of invasive weeds such as Privet, Lantana and Hawaiian Holly.

Most exotic birds are generalists readily moving between gardens, open pasture, weed thickets and native forest dispersing seeds such as Hawaiian Holly, Guava and Olive deep into forest habitat.

The self-introduced Australian Kestrel benefits from new open space and pastures. Although its diet consists largely of insects (predominantly introduced dung beetles) and occasionally small mammals, such as mice and rats, there has been some concern that the Kestrel could have a significant impact on some seabird populations on Phillip Island, particularly the Grey Ternlet.

Image: Phillip and Nepean Islands, © NIRC

THEME 6

Continued

Californian Quail can have an impact on vegetable seedlings in home vegetable patches and could potentially damage native plant seedlings and alter soil biota.

There have been no known planned or coordinated control programs for other introduced birds on Norfolk Island and it is unlikely control programs would be beneficial.

Army Grub

The insect that has the most obvious effect on Kikuyu pastures and lawns across Norfolk Island is the introduced Army Grub (Worm).

The Army Grub is a Noctuid moth of the genus *Spodoptera* and the name Army Grub is a reference to the larvae that emerge in huge numbers, consuming swathes of crops or pasture in their path.

Army grubs emerge in pastures and lawns on Norfolk Island during late summer and autumn, especially after rain. Larger swarms occur in some years when conditions are favourable and can have a dramatic impact on Kikuyu pastures across the Island, causing short term damage to pastures, lawns and fairways on the golf course.

Asian House Gecko

The introduced Asian House Gecko has been recorded at three sites within Burnt Pine on Norfolk Island and is implicated in the decline of some native gecko species in other parts of its introduced range.

The Asian House Gecko is currently absent from Phillip Island but has the potential to severely impact upon the important Lord Howe Island Gecko and Lord Howe Island Skink populations if should it be introduced. Strong biosecurity measures to stop the Asian House Gecko reaching Phillip Island are critical.

There have been no known attempts to contain, control or eradicate Asian House Gecko populations on Norfolk Island.

THEME 6

Continued

Other pest animals

Close to 1,200 invertebrate taxa have been recorded on Norfolk Island, including 421 species that had not been recorded prior to 2014. It is not clear how many of these invertebrates are exotic or invasive and their potential impacts are also unknown.

A new arrival on Norfolk Island is the Palm Seed Borer (*Coccotrypes dactyliperda*), an invasive 1.5-2.5-millimetre-long beetle that breeds in palm seeds, compromising plant reproduction. The Palm Seed Borer could potentially impact on the island's Kentia Palm industry, but the likely impacts on Norfolk's one indigenous palm species *Rhopalostylis bauerii* are unknown.

Colonies of the feral European Honeybee frequently occupy tree hollows that might otherwise be used by native nesting birds, but the impact of feral honeybees on breeding success is unknown and unlikely to be significant in comparison to the Red Parrot.

Future pest animal control programs on Norfolk Island will be implemented according to the Norfolk Island Regional Council Pest Management Plan and Plans of Management for Public Reserves.

Image: Looking out above the Crystal Pools, © NIRC

THEME 6

Continued

Argentine Ant Eradication Program

In early 2010, colonies of the invasive exotic Argentine Ant (Figure 30) were located in Ball Bay, Headstone and Hundred Acres Reserves. It is believed that the infestations in Headstone and Hundred Acres Reserves originated in mulch transported from the waste management centre in 2006 and that the infestation in Ball Bay Reserve originated in tree stumps transported to that reserve from Hundred Acres Reserve in 2007.

Reserves and Forestry staff initiated intensive control baiting in Hundred Acres Reserve in 2010 and subsequent control and monitoring has been carried out as part of the Island-wide Argentine Ant control program funded by the Commonwealth Government.

Image: Argentine Ants

THEME 6

Continued

The presence of Argentine Ants in any native forest or cliffs poses a significant threat to biodiversity. This species of ant forms large colonies that completely eradicate other ants and many other invertebrates. Argentine Ants also swarm on nestlings and nesting adults, putting all birds in an ant infested area at risk. They also can have significant effects on seed production and recruitment of seedlings through interrupting the life cycle of dispersal species. Argentine Ants also have the potential to have a serious impact on tourism accommodation on Norfolk Island.

As colonies will move if disturbed, control/eradication strategies are based on killing the whole colony and especially the queen, in situ.

The inadvertent introduction of this environmental pest on Norfolk Island underscores the need to ensure the development and adoption of appropriately high quarantine standards to the importation of any material onto Norfolk Island.

The implementation of the Argentine Ant Eradication Program is underway with funding from the Australian Government. The Program is (and will continue to be) guided by the CSIRO Argentine Ant Eradication Strategy and implemented by Norfolk Island Regional Council. Results through 2019-20 have been very encouraging, and eradication efforts are currently on track.

THEME 6

Continued

Cattle grazing

Cattle grazing on public lands, including roadsides and some reserves is a long-term tradition on Norfolk Island, having cultural significance to cattle owners and other members of the community. The public herd can access unfenced private land, and landowners who wish to not to have cattle grazing on their land are responsible for cattle exclusions fencing.

Cattle are important for the supply of local beef supply and form part of the cultural backdrop of Norfolk Island.

Without proper management, however, cattle grazing can lead to land degradation, loss of native plant species and impacts on surface and groundwater quality.

Cattle have had a long history of direct access to the bed and banks of waterways on private and public land across the island, leading to eroded banks, increased sedimentation into waterways, and deposition of nutrients directly into waterways. Unrestricted access to the bed and banks of waterways significantly reduces the quality of drinking water supplies and recreational waters, such as Emily Bay.

Image: Cattle roaming freely, grazing on public land © NIRC

THEME 6

Continued

Overgrazing can lead to weakened soil structure and has significantly contributed to erosion on some parts of the island, increasing sediment loads in waterways and reducing the ability of native vegetation to re-establish.

Cattle grazing is a threat to native vegetation communities, as cattle eat and trample native vegetation and spread weeds. Unrestricted grazing is a common practice in some public reserves and can reduce their biodiversity value.

If grazing is reduced in some areas and followed up with weed control and replanting, restoration of vegetation communities is possible. Without follow up weed control and replanting, cattle exclusion often results in woody weed regrowth.

Some weed species are toxic to cattle, such as Cascade onion (*Homeria flaccida*) and the control of this weed has been included in Council weed management programs, even though there is no real ecological reason for such control programs to be undertaken.

Image: Cattle roaming freely, grazing on public land © NIRC

THEME 6

Continued

The Norfolk Island Environment Strategy makes the following recommendation around cattle grazing:

- Cattle access to streams must be reduced.
- Where cattle are excluded from an area, this should be combined with a targeted revegetation and weeding program.
- Adhere to the stocking rate of 211 cattle on the 183.5 ha of public land that was accessible to cattle in 2016, and reduce the number of cattle should pasture be poor or areas be made cattle exclusion zones.
- The number of cattle tags issued by Council for grazing on public land has reduced from 240 in 2015/16 to 170 in 2020/21. This followed a recommendation by GHD (2016) to reduce the stocking rate on common grazing land. This does not mean that the total number of cattle on the island has reduced, but rather a reduced number grazing on roadsides and some public land areas. From a biodiversity perspective the most important thing is where cattle are grazing.
- Steep land vulnerable to erosion and slippage should be protected from grazing.
- Areas of very high conservation value, particularly where threatened plants are on the brink of extinction must be maintained as cattle exclusion zones to comply with requirements not to impact on matters of National Environmental Significance under the *Environmental Protection and Biodiversity Conservation Act, 1999 (Cth)*.

Revegetation

The Norfolk Island National Park nursery now has a limited number (but a good range) of plants available for revegetation on public and private land, and plans are in place to increase production.

The Plans of Management for Public Reserves contain a number of recommendations for revegetation with public reserves, including threatened species projects.

Some revegetation projects involving the community have been implemented during 2021 and will continue if funding allows.

THEME 6 ENVIRONMENTAL TRENDS

Table 17 details available data for indicators for the five years prior to and including 2020-21 for Theme 6 - Biodiversity.

Table 17. Indicators and data for theme 6: biodiversity (July 1 2016 – June 30 2021)

Indicator	16-17	17-18	18-19	19-20	20-21	TREND	Data Confidence (H,M, L)
Population size of threatened flora [1]	Various (see Appendices)					Increase	M
Population size of threatened fauna [1]	Various (see Appendices)					Up and down	M
Volume (no.) of native plants propagated at the Parks Australia native plant nursery for use in public and private restoration	433	1486 (Green Army)	11,000 (3,666/yr)			Increase	M
Number of feral cats trapped by Council	139	63	103	54	46	Up and down	M-H
Number of feral cats trapped by Parks Australia	36	34	50	39	44	Up then down	M-H
Number of domestic cats desexed [2]	26	22	43	40	46	Increase	H
Number of domestic cats microchipped [2]	10	6	12	38	39	Increase	H
Number of cats imported p.a.	2	7	4	8	11	Increasing	H
Number of feral chickens eradicated by Council	500	817	417	754	1141	Increase except for 18/19	
Number of feral chickens eradicated by Parks Australia	104	61	131	422	431	Increase	H
Number of tarler birds culled by Parks Australia and their contractors	14	4	40	84	109	Increase	M-H
Number of tarler birds culled by Council	unknown	unknown	unknown	28	27	Stable	M-H
Number of red parrots culled by Parks Australia	451	171	283	373	646	Increasing (down then up)	M-H

THEME 6

Continued

Indicator	16-17	17-18	18-19	19-20	20-21	TREND	Data Confidence (H,M, L)
Number of red parrots culled by Council	unknown	unknown	unknown	274	253	Decreasing	M-H
Estimated size (density) of the rat population within the National Park. [3]	unknown	unknown	unknown	14/ha	14/ha	unknown	M
Area of land affected by Argentine Ants (hectares) [4]	300	300	325	350	340	Increase	M - because we never have accurate maps for all places at all times
Area of land treated for Argentine Ants (hectares)	21.4	13	27	96.5	80.7	Up and down, but overall increase	M
Formosan lily population (Number of Formosum lily flowers/stems handed in under the Flora and Fauna Society annual Bounty program) [5]	15,500	18,810	40,775	25,750	55,150	Increase	M-H
Number of native trees planted on Council land	0	0	0	50	722	Increase	M
Number of trees planted in National Park [6]	1097	1486	2006	2190	1578	increase then down in last year	L-M
Area of revegetation with native species on Council land (hectares)	0	0	0	0	0.8	Stable	L-M
Area of revegetation with native species in National Park (hectares)	insufficent data	insufficent data	1	1	1	Stable	L-M
Area of remnant native vegetation enhancement through weed control on Council land (hectares)	0	0	0	0	24.3	Increase	M
Area of native vegetation enhancement through weed control in National Park (hectares)	unknown	6	6	6	18	Stable then up	L
Area of remnant native vegetation enhancement through new fencing on Council land (hectares)	0	0	0	0	2.5	Stable then increase	L-M

THEME 6

Continued

Indicator	16-17	17-18	18-19	19-20	20-21	TREND	Data Confidence (H,M, L)
Area of native vegetation enhancement through new fencing in National Park (hectares)				1		Stable	M
Number of protected trees approved for removal through Permits	73	192	136	119	249	Increase	H
Area of conservation value public land grazed by cattle (hectares)	unknown	unknown	unknown	unknown	unknown	unknown	M
Total area/extent of native vegetation cover (hectares) [7]	unconfirmed	unconfirmed	unconfirmed	606	606	unknown	L-M

Footnotes

1. Population estimates for threatened species are provided in Appendix 1.
2. Six set vet clinics held in Sept 19, Feb 20, May 20, Sep 20, March 21, June 21 resulted in 81 cats microchipped and 60 cats desexed (29 male, 31 female).
3. Modelled rat density is provided from 2019/20. An activity index is in development and could be used as a future indicator.
4. Argentine Ants – maps are not always accurate/reflective of the current situation for all places at all times. although the area of land affected has been increasing, this is because the work has focused on eradicating numerous smaller populations while the larger populations are left unmanaged and are allowed to grow. It is also worth noting that the area remaining infested by 2021/22 is estimated to be 220ha.
5. The data for the Formosan lily program can be interpreted as both a positive (more weeds removed) and a negative (more weeds available for removal). The aim of the program was to reduce the further spread of the weed and engage the community.
6. The first 3 years are estimates. For the last two years the figures are likely to be an under representation (based on hard copy records without locations).
7. The total area of native vegetation figure is meant to account for the area of remnant native vegetation + area of revegetation – losses due to native revegetation clearing. However, as there is no sufficient data collection or accounting of these gains and losses across the island, the area mapped by Mills and Christian (2020) is used. There is likely to be a decline of total area of native vegetation in the absence of an offset scheme for tree removals, ongoing weed encroachment, grazing pressure and no incentive program for private land conservation.

THEME 6 RECOMMENDATIONS

Table 18

Indicator change	Reason	Action (change, remove or add)	Addressed in this Report (Y/N)
New indicator: Amount of funding received for conservation projects	Good measure of action and progress over time	Add	N
New indicator: No. of free-roaming cats	Cats are a major threat to biodiversity on Norfolk Island	Add	N (modelled no. of cats in 2020) is recorded and cited in the report
New indicator: No. of research projects underway	Measure of improved knowledge to make more effective management decisions	Add	N
New indicator: No. of cats imported to the island	Cats are a major threat to biodiversity on Norfolk Island	Add	N (only a snapshot during special vet clinics funded by Aust government)
New indicator: No. of cats microchipped	Effective tool for management of cats	Add	N (only a snapshot during special vet clinics funded by Aust government)
New indicator: No. of cats imported to the island	Cats are a major threat to biodiversity on Norfolk Island	Add	Y
New indicator: No. of domestic cats on Norfolk Island	Domestic cats that roam can also have a significant impact on wildlife. The estimation of 500 cats on record at the local vet suggests a very high number of domestic cats in a location where they are known to be a major predator.	Add	N

THEME 6

Continued

Indicator change	Reason	Action (change, remove or add)	Addressed in this Report (Y/N)
Remove: No. of new invasive pest plants, animals, pathogens or diseases detected	This indicator is already addressed under Theme 3. There is potential to keep something similar specific to biodiversity however this is unlikely to change on an annual basis.	Remove	Y
New indicator: No of pest animals (feral chooks, red parrots, tarler birds) culled	Pest animal control is important to conserve biodiversity and to track over time. This data is available at least for the most recent years.	Add	Y
New indicator: area of revegetation on Council land, in national Park and on private land)	Habitat protection and restoration is a key requirement to reverse biodiversity decline.	Add	Y (on Council land and National Park; private land should be measured in the future)
New indicator: Area of native vegetation enhanced through weed control	As above	Add	Y - As above
New indicator: Area of native vegetation enhanced though new fencing	As above	Add	Y - As above
New indicator: No. of trees approved for removal through permits	Loss of native vegetation and habitat is a key threat to biodiversity and should be monitored.	Add	Y
New indicator: Number of trees planted through a council tree offset scheme	As above. Offset scheme not yet in place.	Add	N
New indicator: Public Conservation areas grazed by cattle (ha)	Unmanaged cattle grazing in natural areas has been a major contributor to environmental decline over many years on Norfolk Island. Recent and ongoing attempts to address this will hopefully see the state of biodiversity and water quality improve.	Add	N
Consider adding: Number of cattle tags issued for grazing on public land	Biodiversity benefits will arise through better management of grazing on the island. However the location of the grazing in relation to biodiversity assets is more important than the number grazing on public land/roadsides.	Consider relevance /adding	N

THEME 6

Continued

Data collection

- Record revegetation (ha)
- Record weed control (ha)
- Develop a methodology for tracking native vegetation gains and losses in the context of targets to improve the extent and condition of native vegetation.
- Align outputs recorded across key organisations, namely NIRC and Parks
- Partner organisations to meet annually, to review joint / island-wide progress (as proposed in the updated Threatened Species Recovery Plan [Director of National Parks in prep.])
- Develop a MOU with the local vet to support residents to be better cat owners and to share data with relevant organisations relating to cat registrations, desexing, microchipping, number on island etc.
- Assess the conservation value of remaining native vegetation on the island, including on private land where landholders are willing to participate. Establish a new indicator for the area of high conservation value areas protected through regulatory and voluntary means.

CASE STUDY 1

THE NORFOLK ISLAND MOREPORK

NINOX NOVAESEELANDIAE UNDULATA

Figure 30. Norfolk Island Morepork Owl

CASE STUDY 1
THE NORFOLK ISLAND MOREPORK

Source: Director of National Parks in prep

Conservation Significance

Endemic to Norfolk Island.

EPBC Act Listing Status: Endangered

Non-statutory Listing Status: Described as Critically Endangered in the Action Plan for Australian Birds 2020 (Garnett & Baker 2021).

CASE STUDY 1

Continued

The Norfolk Island morepork (or boobook owl) was first recorded by King in 1788–90. Since 1909 the owl had been recorded as occurring largely in the gullies surrounding Mt Pitt (Smithers & Disney 1969; Olsen et al. 1989). A reasonable population remained in 1912–13 but by 1968 the owl was considered extremely rare and was heard only occasionally (Turner et al. 1968, Smithers & Disney 1969). By 1986 the population had declined to a single female.

Two males from the closely related New Zealand subspecies were introduced in 1987. In 1989 the Norfolk female and one of the NZ males raised their first chicks. They also produced chicks in 1990 but those were the last chicks produced by the Norfolk female, and she was last recorded in October 1995. There has been subsequent second and third generation breeding with 45 'hybrid' offspring banded up to December 2007.

Image: Norfolk Island Morepork Owl

CASE STUDY 1

Continued

The current population is likely to be derived from two individuals (the last female Norfolk Island morepork Ninox n. undulata and one of the introduced male N. n. novaeseelandiae; Olsen et al. 1989).

Successful breeding was observed in every year from 1993 to 2007. Subsequently, a single successful breeding event was observed between 2008 and 2018 (successful breeding in 2011 only). In 2016, there were estimated to be 32 individuals (Wilson 2016); estimates from more recent surveys reported a population of 20–30 (Sperring et al. 2021a). After the establishment of new nest boxes, one nest found in 2019 produced two fledglings, while a single nest found in 2020 (believed to be from the same pair and in a box near the location of the successful nest in 2019) had eggs that did not hatch (Sperring et al. 2021b). Although surveys in 2019, 2020 and 2021 detected just two previously banded birds of the 12 captured, indicating that undetected breeding has occurred at some point, the population possibly consists of ageing birds that are not reproducing at a sufficient rate to maintain the population.

Image. Nick Bradsworth with Norfolk Islands Morepork Owl

CASE STUDY 1

Continued

The population is now fairly evenly distributed across the entire national park with a higher density on the southern slopes of Mt Pitt and Mt Bates. Tracking data from spring 2019 and 2020 showed that the average territory size for owls living mostly within the national park was 48 hectares while the average size for owls outside of the park was 128 hectares. Territory sizes during winter are similar to those in spring, though one owl tracked during winter, and displaying behaviour suggestive of searching for a mate, had a territory size of 389 hectares. Because owls occupy small territories in the national park, the population density is much higher there; owls are located more sparsely across the rest of the island (Sperring et al. 2021b).

Prior to 2010, a morepork was heard calling once on nearby Phillip Island, suggestive of a dispersing individual (O. Evans pers comm. to D. Ball), but no further reports of owls on Phillip Island have been made since then. All recent breeding has taken place in Norfolk Island National Park (Sperring 2021a,b).

Image: Norfolk Island Morepork Owl

CASE STUDY 1

Continued

Ecology

Breeding: Breeds September to January. Clutch size can be up to four eggs, but two eggs per clutch is more common.
Nest: Nests in tree hollows. All nests of the hybrid population have been in artificial nest boxes, although breeding is suspected to have occurred in natural hollows.
Feed primarily on insects, in particular orthopterans and coleopterans, as well as rodents, passerines (including the Norfolk Island robin and slender billed white-eye) and white terns (Olsen 1996, Sperring et al. 2001b).

Habitat

Norfolk Island moreporks prefer native woody vegetation, introduced guava or Eucalyptus plantation to open land and other woody weeds. They also prefer canopy height above 10 m (Sperring, unpublished data). Moreporks mostly roost at the top of the canopy underneath foliage. They are most commonly found in native trees (particularly ironwood and bloodwood) but have also been seen roosting in guava, olive and banana plantations.

Image: Flossy Sperring with Norfolk Islands Morepork Owl

CASE STUDY 1

Continued

Threats

The decline of the morepork was probably caused by a combination of unrelated environmental and demographic and genetic forces acting on a naturally small population. The main factors are likely to be: the loss of c.30 individuals from the population for a natural history collection in 1913, the loss of suitable habitat and nesting hollows caused by land clearing and selective logging of large trees, as well as competition for hollows from introduced species such as rosellas and starlings. Current major threats include the likely chance of inbreeding depression and lack of suitable nesting sites. Low habitat suitability across the island is also likely to reduce the carrying capacity of the island putting pressure on the population to maintain genetic diversity (Sperring et al. 2021a). Secondary poisoning from rodent and chicken baiting is also a threat (likely cause of death of two chicks in 2012 (Debus 2012) and near death of one likely poisoned adult in 2021 (Sperring et al. 2021b). Predation of eggs and chicks by rats and cats is also a possible threat. Weed invasion (including by red guava Psidium cattleianum, African

Image: Norfolk Island Morepork Owl (infant)

CASE STUDY 1

Continued

olive Olea europaea, wild tobacco Solanum mauritianum and lantana Lantana camara) and resulting change in forest structure is also likely to effect owls' ability to hunt (Wilson 2016).

Impact on Other Species

None known

Management Actions

Maintenance of suitable nest boxes (particularly in appropriate locations) is likely to improve the breeding success of individuals within the population. Immediate habitat restoration outside of the national park is also recommended to increase the carrying capacity of the island and reduce the pressure of maintaining genetic diversity. Genetic rescue through the introduction of individuals from New Zealand or Australia may be required in future. Prevention or serious reduction in the use of second-generation baits outside of the national park is also likely to assist the population.

Image: Norfolk Islands Morepork Owl

CASE STUDY 1

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Image: Norfolk Island Morepork Owl

CASE STUDY 1

Continued

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SUMMARY OF RECOMMEND-ATIONS FOR FUTURE STATE OF THE ENVIRONMENT

Recommendations in this report relate specifically to indicators, data collection and monitoring. These have been developed based on an assessment of what is most relevant and feasible to measure over time, consideration of data that is already being collected, obvious gaps identified and guidance from criteria for the selection of core indicators (ANZECC 2000), as below.

Core indicators should:

- reflect a valued element of the environment or an important environmental issue;
- have relevance to policy and management needs;
- be useful for tracking environmental trends at a range of spatial scales from the local to the continental;
- be scientifically credible;
- be cost effective;
- serve as a robust indicator of environmental change;
- be readily interpretable;
- be monitored regularly, either by existing programs or by new programs that might be established in the future at reasonable cost.

SUMMARY OF RECOMMENDATIONS FOR FUTURE STATE OF THE ENVIRONMENT

The development of recommendations pertaining to the achievement of outcomes or actions against themes in the Environment Strategy is a separate process that should feed into Council's annual reporting and periodic reviews of strategies (e.g. annual, mid and/or full term).

Recommendations across all six themes are summarised below, followed by general recommendations.

THEME 1 ENERGY, TRANSPORT UTILITIES AND RESOURCES

Main Recommendations

1. Revision: Use total vehicle registrations, rather than distinguishing between light and heavy.
2. Revision: LPG taken from the storage at Ball Bay
3. New indicator: No. of rooftops with PV solar panels
4. New indicator: add Tonnes of rock sold on the island

Data collection

- Energy use – ensure internal systems allow for measurement of per household and Council building, as well as commercial buildings (which would be an additional indicator). Data on residences and previous work to formulate the waste charge may assist.
- Timber harvested and imported – establish a process to better record what is grown and harvested locally versus imported.
- Solar power – imbed a process to track changes in the number of photovoltaic solar power systems on the island, in anticipation of the moratorium being lifted in the near future.
- Registered tree plantations – remind the community of the need to register new tree plantations and imbed an internal process/procedure to record these registrations under the Trees Act 1997 (NI). Attempts in 2021 to obtain data on the number of registered plantations revealed there is no known location/register for this at NIRC.

THEME 2 WASTE

Main Recommendations

1. New indicator/s: Include data currently collected but not listed as indicators in the Environment Strategy (exports of Asbestos, waste oils, chemicals, cardboard, batteries).
2. New indicator: waste import levy
3. New indicator: volume of waste dumped into the sea at headstone
4. New indicator: measure the overall volume of waste dropped to the WMC for processing
5. New indicator: develop a way to assess the level of incineration and dumping of waste on private land

Data collection

- As of November 2021, disposing of waste into the sea at Headstone Disposal centre will cease. Monitoring the implications (diversions) of this will be important, as will compliance.
- Record all complaints (verbal and written) made to the Environment and Waste team of NIRC.
- Develop a central/shared database where data is entered and can be viewed and used for multiple sources as a single point of truth.
- Undertake routine record-keeping (aligned to indicators) to assist with reviews such as this in the future. For example, recording the number of times recreational waters exceed guidelines .

Other

- Investigate the reasons behind the drop in WMC ticket sales over the life of this Report.
- Enforce breaches of the Environment Act 1990 (NI) to reduce harmful pollution for burning by landowners.
- Set targets for reducing waste based on priority measures in Table 5. These would be more specific than the overarching goals for waste management under the Norfolk Island Regional Council Delivery Program 2016–2020, and align with the targets in the Waste Management Strategic Plan.

THEME 3 SUSTAINABLE FOOD SUPPLY FROM THE LAND AND SEA

Main Recommendations

1. Revised indicator: Potentially change number of food types to volume of food produced locally (or both). Limit to commercial food.
2. New indicator: Type and quantity of food imported to the island.
3. New indicator: Commercial fishing catch rate (tonnes)

Data collection

- Liaise with the Fishing club to regarding improved data collection in the future, potentially as part of the MOU.
- Pests: Note – At the time of producing this report, The Department of Infrastructure, Transport, Regional Development and Communications commenced a Norfolk Island pest and disease survey, focused on bees, plants, the marine environment and terrestrial animals. These surveys will build on the 2012-2014 Quarantine survey (Maynard et al. 2018), updating data and filling gaps. This will be a key reference for future SoE Reporting on Norfolk Island.
- Develop a sustainable food strategy that includes suitable indicators and actions for relevant data collection.

THEME 4 CLEAN WATER IN OUR TANKS AND MARINE AREAS

Main Recommendations

1. Revised indicator: Breaches to be reported as percentages instead of numbers
2. New indicator: Include more specific indicators where data collection is feasible
3. New indicator: Acid Sulfate Soils (ASS) - Percentage of times that pH in freshwater sites affected by ASS was below 5 (or 4.5 or limit to be advised)
4. New indicators (marine waters): (using default ANZECC guidelines for SE Australia until Norfolk Island-specific guidelines are developed [reported as ug N/L rather than as ug NOx or NH4+ /L for comparison to these trigger values
5. New indicator/s: Related to the marine environment (e.g. algal blooms, pest species and disease outbreaks, extent and condition of native habitats)

Data collection

- Identify the number and condition of on-site sewage systems across the island to better understand the impact they are having on the environment and appropriate management.
- Define (to be addressed by CSIRO) and use Norfolk Island specific trigger values for future water quality monitoring where available.

THEME 5 POPULATION, PLANNING AND RETAINING OPEN SPACES

Main Recommendations

1. Revised indicator: Remove no. of households with telephone numbers and ADSL internet connections
2. Revised indicator: Show data for average rainfall on a monthly basis
3. New indicator: No. of commercial/community/public dwellings

Data collection

- Establish a reliable source of truth for the island's population.
- Ensure future SoE Reporting links to any indicators that may emerge as part of the population assessment/sustainable population strategy.

THEME 6 BIODIVERSITY

Main Recommendations

1. New indicator: Amount of funding received for conservation projects
2. New indicator: No. of free-roaming cats
3. New indicator: No. of research projects underway
4. New indicator: No. of cats imported to the island
5. New indicator: No. of cats microchipped
6. New indicator: No. of cats imported to the island
7. New indicator: No. of domestic cats on Norfolk Island
8. Remove: No. of new invasive pest plants, animals, pathogens or diseases detected
9. New indicator: No of pest animals (feral chooks, red parrots, tarler birds) culled
10. New indicator: area of revegetation on Council land, in national Park and on private land)
11. New indicator: Area of native vegetation enhanced through weed control
12. New indicator: Area of native vegetation enhanced though new fencing
13. New indicator:No. of trees approved for removal through permits
14. New indicator: Number of trees planted through a council tree offset scheme
15. New indicator: Public Conservation areas grazed by cattle (ha)
16. Consider adding: Number of cattle tags issued for grazing on public land

Data collection

- Record revegetation (ha)
- Record weed control (ha)
- Develop a methodology for tracking native vegetation gains and losses in the context of targets to improve the extent and condition of native vegetation.
- Align outputs recorded across key organisations, namely NIRC and Parks
- Partner organisations to meet annually, to review joint / island-wide progress (as proposed in the updated Threatened Species Recovery Plan [Director of National Parks in prep.])
- Develop a MOU with the local vet to support residents to be better cat owners and to share data with relevant organisations relating to cat registrations, desexing, microchipping, number on island etc.
- Assess the conservation value of remaining native vegetation on the island, including on private land where landholders are willing to participate. Establish a new indicator for the area of high conservation value areas protected through regulatory and voluntary means.

GENERAL RECOMMEND-ATIONS (ACROSS THEMES)

- Ensure alignment between Environment Strategy (themes and indicators) and data collection carried out by NIRC and relevant partners (including instilling a culture of considering the strategic context for all monitoring).
- Develop processes and templates to enable ease of data collection and periodic review.
- Align and potentially combine NIRC's SoE reporting with NIRC's annual reporting process.
- Update databases/registers within Council that pre-date the Environment Strategy to ensure relevant parameters are being captured for ongoing monitoring, evaluation and reporting.
- Further analyse the status of environmental indicators (declining or improving states/trends) to help drive strategic prioritisation of actions within the Environment Team (and internal/external partners). There are clearly some areas within each environmental theme that require urgent attention to avoid ongoing decline to environmental assets. This could be done in conjunction with a review of the Environment Strategy, due to sunset in 2023.

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APPENDICES

APPENDIX 1 TREND INFORMATION FOR THREATENED SPECIES POPULATIONS ON NORFOLK ISLAND

Changes in knowledge and conservation trajectory (sourced from the draft Norfolk Island Region Threatened Species Recovery Plan, Director of National Parks, in prep.)

The table below shows the estimated population sizes of the threatened species for the Norfolk Island Region at the beginning and end of the last Recovery Plan (2010).

Of the 58 listed threatened species covered by this plan, 31 (53%) have seen increases in population size since the commencement of the 2010 recovery plan. The majority of these have been plant species (29). These include increases in populations of 12 of the 15 critically endangered plants, 8 of the 16 endangered plants and 9 of the 15 vulnerable plant species. These increases have resulted in large part from woody weed control in the park over many years and a dedicated threatened flora program initiated by Parks Australia in 2018. The program involves seed collections, propagation trials and raising seedlings in the Norfolk Island National Park nursery, as well as reducing the impact of

APPENDIX 1

Continued

weed species and predation by rodents and chickens, resulting in increased juvenile recruitment and competitive advantage. The nursery-grown plants are being translocated back into the wild in suitable locations, with the aim of increasing numbers of existing populations as well as establishing them in additional locations within the park. Beyond the park, provision of plants to the Norfolk Island Regional Council, the Department of Infrastructure, Transport, Regional Development, and Communications, and the Norfolk Island community has enabled island-wide habitat rehabilitation works to occur, with over 2000 plants disseminated. Notable examples of species recovery through this program include Wikstroemia australis (kurrajong) increasing from 155 to 629 individuals, Boehmeria australis subsp. australis (Norfolk Island nettle) increasing from 259 to 591 individuals, and Hibiscus insularis (Phillip Island hibiscus) increasing from 100 to 300 individuals.

Increases have also been seen in two threatened bird species (the Norfolk Island green parrot (from an estimated 240 in 2010 to an estimated 438 in 2021) and the Kermadec petrel (from 100 to 150). Management activities responsible for the green parrot recovery have included maintaining predator-proof nest sites, restoring habitat and controlling rats, cats and crimson rosellas. The improved trajectory of the Kermadec petrel has been due to a concerted effort to reduce the impact of swamphen predation on nests since 2019, with the control program resulting in increased breeding success in 2020 and 2021.

Apparent decreases have occurred in two bird species, the morepork (from 40 to 25), and the Norfolk Island robin (from 800 to 750); and two plant species, the Phillip Island chaff-tree (from 20 to 14) and Phillip Island wheat grass (from 50 to 5).

Robust baseline data was not available for the threatened snails, so trends have not been able to be estimated; however, recent monitoring has provided baseline data for Advena campbellii and Mathewsoconcha suteri. The other three snails are presumed extinct.

APPENDIX 1

Continued

Robust baseline data was not available for the threatened snails, so trends have not been able to be estimated; however, recent monitoring has provided baseline data for Advena campbellii and Mathewsoconcha suteri. The other three snails are presumed extinct.

For the remaining two reptiles and 15 plant species, recent population estimates are not available, so trends over the plan period cannot be determined.

Species population estimates in 2010 and 2021

Species	Common name	EPBC Act Status	Estimated population* (2010)	Estimated Population* (2021)	Trend	Confidence in trend
Molluscs						
Advena campbellii	Campbell's helicarionid land snail	Critically Endangered	?	150	Unknown	
Mathewsoconcha grayi	Gray's helicarionid land snail	Critically Endangered	Extinct	Extinct?		
Mathewsoconcha phillipii	Phillip Island helicarionid land snail	Critically Endangered	6	Extinct?	Decrease	
Mathewsoconcha suteri	a helicarionid land snail	Critically Endangered	?	50	Unknown	
Quintalia stoddartii	Stoddart's helicarionid land snail	Critically Endangered	Extinct	Extinct?		

Species	Common name	EPBC Act Status	Estimated population* (2010)	Estimated Population* (2021)	Trend	Confidence in trend
Reptiles						
Christinus guentheri	Lord Howe Island gecko	Vulnerable	176000	176000	Stable	Medium
Oligosoma lichenigerum	Lord Howe Island skink	Vulnerable		7900?	Unknown	

APPENDIX 1

Continued

Species	Common name	EPBC Act Status	Estimated population* (2010)	Estimated Population* (2021)	Trend	Confidence in trend
Birds						
Cyanoramphus cookii	Norfolk Island green parrot	Endangered	240	438 (270–606)	Increase	Medium
Ninox novaeseelandiae undulata	Norfolk Island morepork, boobook owl	Endangered	40	25 (20–30)	Decrease	Medium
Pachycephala pectoralis xanthoprocta	Norfolk Island golden whistler, tamey	Vulnerable	2300	1671 (1372–1970)	Stable	Low
Petroica multicolor	Norfolk Island robin	Vulnerable	800	750 (700–800)	Decrease	Medium
Pterodroma neglecta neglecta	Kermadec petrel (western)	Vulnerable	100	150	Increase	High

Species	Common name	EPBC Act Status	Estimated population* (2010)	Estimated Population* (2021)	Trend	Confidence in trend
Flora						
Abutilon julianae	Norfolk Island abutilon	Critically Endangered	43	227	Increase	
Achyranthes arborescens	Chaff tree, soft-wood	Critically Endangered	109	391	Increase	
Achyranthes margaretarum	Phillip Island chaff-tree	Critically Endangered	20	14	Decrease	
Anthosachne kingiana subsp. kingiana	Phillip Island wheat grass	Critically Endangered	50	5	Decrease	
Blechnum norfolkianum	Norfolk Island water-fern	Endangered	708	708	Stable	

APPENDIX 1

Continued

Species	Common name	EPBC Act Status	Estimated population* (2010)	Estimated Population* (2021)	Trend	Confidence in trend
Flora (continued)						
Boehmeria australis subsp. australis	Tree nettle, nettletree	Critically Endangered	259	591	Increase	Medium
Calystegia affinis	A creeper	Critically Endangered	13	28	Increase	Medium
Clematis dubia	Clematis	Critically Endangered	53	303	Increase	High
Coprosma baueri	Coastal coprosma	Endangered	446	708	Increase	Medium
Coprosma pilosa	Mountain coprosma	Endangered	338	420	Increase	Medium
Cordyline obtecta	Ti	Vulnerable	818	1863	Increase	Medium
Dendrobium brachypus	Norfolk Island orchid	Endangered	200	200	Unclear	Low
Dysoxylum bijugum	Sharkwood	Vulnerable	870	940	Stable	Medium
Elatostema montanum	Mountain procris	Critically Endangered	11	26	Increase	Low
Euphorbia norfolkiana	Norfolk Island euphorbia	Critically Endangered	104	388	Increase	High
Euphorbia obliqua	A herb	Vulnerable	530	1344	Increase	Low
Hibiscus insularis	Phillip Island hibiscus	Critically Endangered	100	350	Increase	High
Hypolepis dicksonioides	Downy ground-fern, brake fern, ground fern	Vulnerable	500	506	Stable	Medium
Ileostylus micranthus	Mistletoe	Vulnerable	500	500	Unclear	Low
Lastreopsis calantha[1]	Shield-fern	Endangered	148	148	Stable	Medium
Marattia salicina (Ptisana salicina) [2]	King fern, para, potato fern	Endangered	44	160	Increase	High

APPENDIX 1

Continued

Species	Common name	EPBC Act Status	Estimated population* (2010)	Estimated Population* (2021)	Trend	Confidence in trend
Flora (continued)						
Melicope littoralis	Shade tree	Vulnerable	273	305	Stable	Low
Melicytus latifolius	Norfolk Island mahoe	Critically Endangered	16	148	Increase	High
Melicytus ramiflorus subsp. oblongifolius	Whiteywood	Vulnerable	436	570	Increase	Medium
Meryta angustifolia	A tree	Vulnerable	479	494	Stable	Medium
Meryta latifolia	Broad-leaved meryta	Critically Endangered	110	395	Increase	Medium
Muehlenbeckia australis	Shrubby creeper, pohuehue	Endangered	100	100	Stable	Medium
Myoporum obscurum	Popwood	Critically Endangered	30	417	Increase	High
Myrsine ralstoniae	Beech	Vulnerable	562	1789	Increase	Medium
Pennantia endlicheri	Pennantia	Endangered	680	791	Increase	Medium
Phreatia limenophylax	Norfolk Island phreatia	Critically Endangered	5	5	Unclear	Low
Phreatia paleata	An orchid	Endangered	27	27	Unlear	Low
Pittosporum bracteolatum	Oleander	Vulnerable	921	1349	Increase	Medium
Planchonella costata	Bastard ironwood	Endangered	176	251	Increase	Medium
Polyphlebium endlicherianum	Middle filmy fern	Endangered	200	200	Unclear	Low
Pteris kingiana	King's brakefern	Endangered	93	483	Increase	Medium
Pteris zahlbruckneriana	Netted brakefern	Endangered	35	35	Unclear	Low
Senecio australis	A daisy	Vulnerable	500	1454	Increase	Low

APPENDIX 1

Continued

Species	Common name	EPBC Act Status	Estimated population* (2010)	Estimated Population* (2021)	Trend	Confidence in trend
Flora (continued)						
Senecio evansianus	A daisy	Endangered	200	200	Unclear	Low
Senecio hooglandii	A daisy	Vulnerable	550	550	Unclear	Low
Streblus pendulinus	Siah's backbone	Endangered	187	259	Increase	Medium
Taeniophyllum norfolkianum	Minute orchid, ribbon-root orchid	Vulnerable	500	500	Unclear	Low
Tmesipteris norfolkensis	Hanging fork-fern	Vulnerable	500	500	Unclear	Low
Ungeria floribunda	Bastard oak	Vulnerable	502	502	Stable	Medium
Wikstroemia australis	Kurrajong	Critically Endangered	155	629	Increase	High
Zehneria baueriana	Native cucumber, giant cucumber	Endangered	180	180	Stable	Medium

APPENDIX 2 NATIVE VEGETATION PLANT COMMUNITIES AND THEIR DISTRIBUTION

MILLS, K. & CHRISTIAN, N. (2020)

Overview

Prior to 2020, there was no comprehensive, island-wide description or map of the native plant communities present. The Norfolk Island Vegetation Mapping Project commenced in 2018 and sought to produce island-wide vegetation maps of Norfolk Island: one showing current native plant communities and another showing the native plant communities predicted to have been present in 1750.

The maps and associated information in the report, The Native Plant Communities of Norfolk Island, provide an improved technical framework for describing the island's native vegetation that can help prioritise areas for restoration and help Norfolk Island landholders obtain funding to restore their land. It can also assist in defining areas that are better suited to other land uses such as grazing, agriculture and development.

Full report: The Native Plant Communities of Norfolk Island.

A series of fact sheets have also been produced as part of this work.
The plant community maps are also available on the Norfolk Island Regional Council website.

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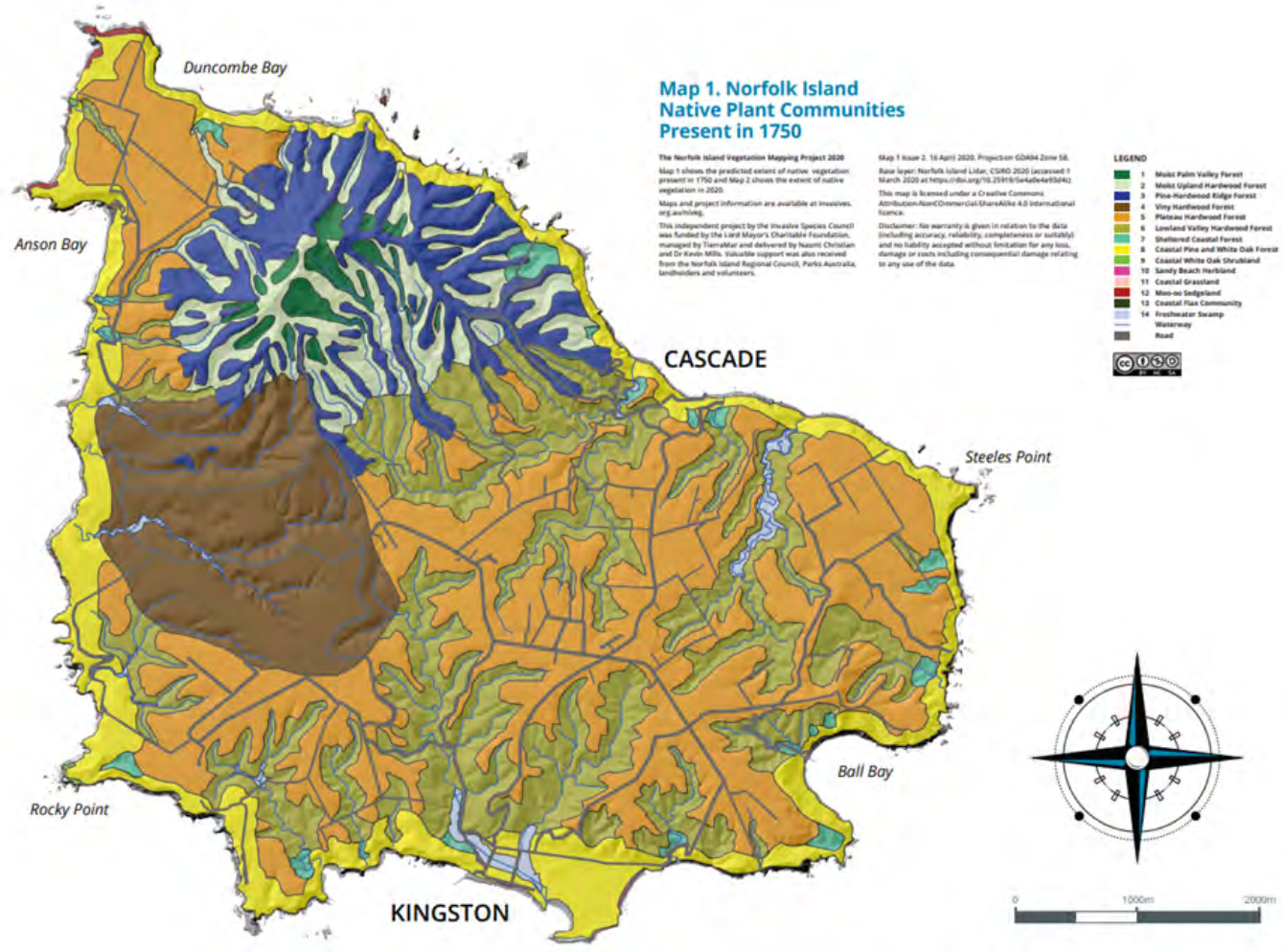
Maps



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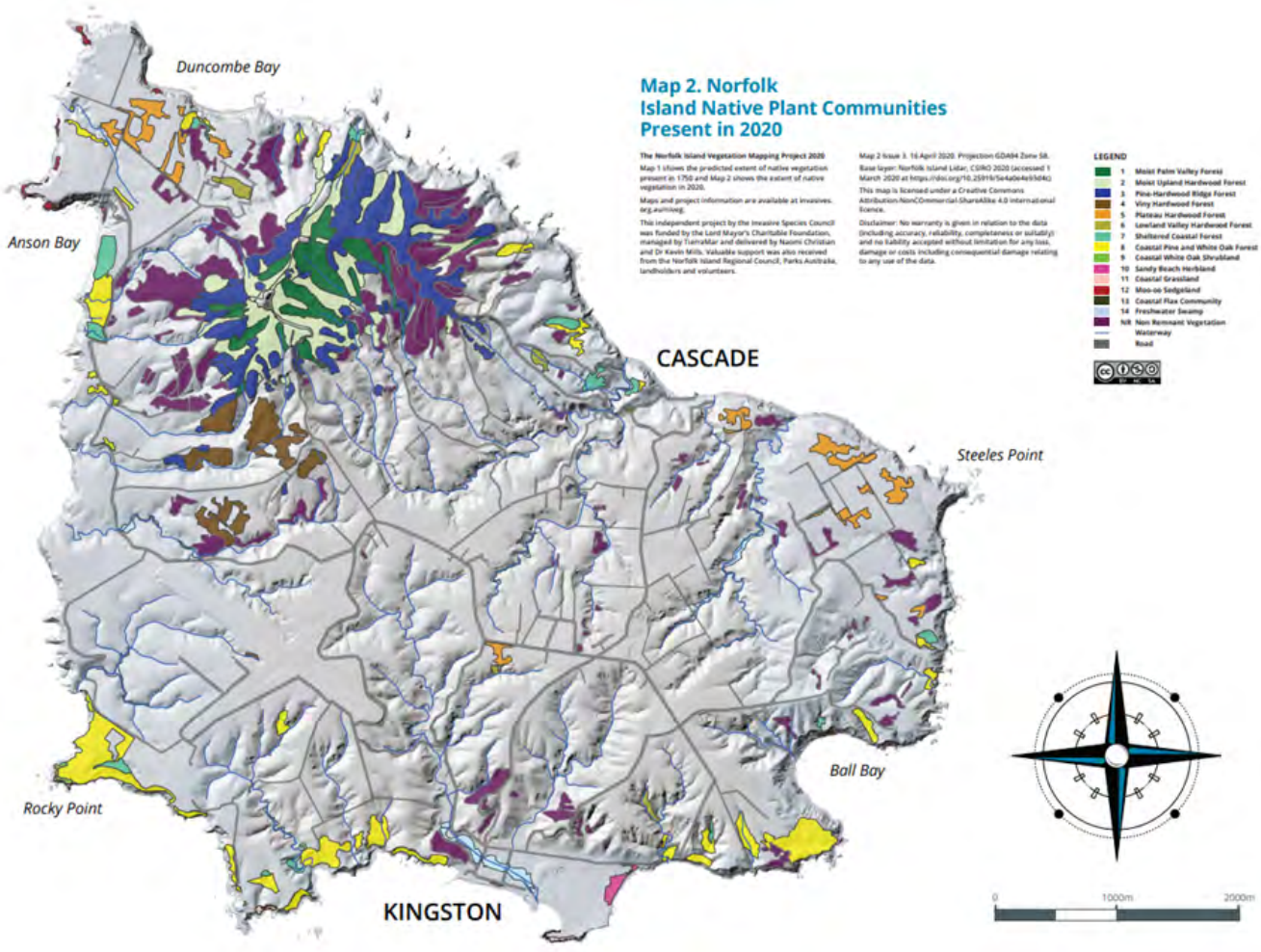
Maps



Aerial view of a valley in Ball Bay Reserve, Norfolk Island © Jim Castles