NIWA
Taihoro Nukurangi

G.41

Statement of Corporate Intent 2020/21

SCIENCE FOR A RESILIENT FUTURE

CLIMATE, FRESHWATER & OCEAN SCIENCE

CLIMATE SCIENCE

New Zealand's pre-eminent provider of atmospheric and climate science

- Climate change and variability
- High-precision weather forecasting
- Weather-related hazard forecasting
- Adaptation and mitigation

Annual snowline surveys began in 1977 and provide a valuable long-term record of how New Zealand's glaciers have retreated over time due to climate change. *[Rebekah Parsons-King]*

230

Science staff

New Zealand's largest team of climate scientists

$42M

Annual investment

In weather and climate research

7,500

Climate stations

The National Climate Database with information from 7,500 climate stations covering New Zealand, South-West Pacific and Antarctica

$18M

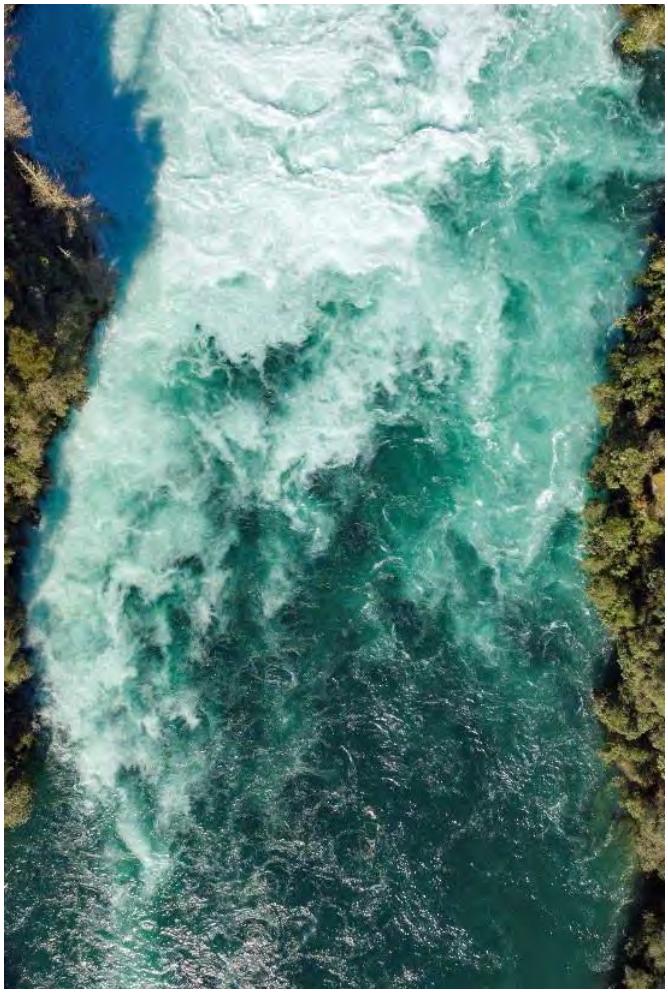
Supercomputer

Enabling precise, highly localised forecasts

FRESHWATER SCIENCE

Supporting the sustainable management of our freshwater resources

- Freshwater quality and quantity
- Biodiversity and biosecurity
- Sustainable use
- Flood forecasting



Aerial view of Huka Falls, Taupo. Close to one-quarter of a million litres of water per second flow over the 11-metre waterfall. *[Dave Allen]*

240

Science staff

New Zealand's largest team of freshwater scientists

$40M

Annual investment

Increasing knowledge of water quantity and quality

66,000

A National Flood Forecasting Service

Providing river flow forecasts for 66,000 catchments nationwide

500

Hydrological Monitoring Stations

A nationwide network of water and soil moisture monitoring stations

OCEAN SCIENCE

Understanding, managing and maximising the benefits of our marine estate

- New Zealand's Marine Estate
- Sustainable use of marine resources
- Biodiversity and biosecurity
- High-value finfish aquaculture

NIWA's deepwater research vessel *Tangaroa* entering Wellington Harbour. *[Dave Allen]*

260

Science staff

New Zealand's largest team of ocean scientists

$67M

Annual investment

In coast and ocean, fisheries and aquaculture science

Northland Marine Research Centre

New Zealand's leading science facility for finfish aquaculture

State-of-the-art Research Vessels

Supporting the New Zealand science community

NIWA
Statement of Corporate Intent 2020/21

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Cover: Few elements of New Zealand's natural capital rank as highly as freshwater, yet it is under pressure in terms of both availability and quality. Maitai Falls, Nelson. *[Rebekah Parsons-King]*

Chairman and Chief Executive's Overview

We are pleased to present NIWA's 2020/21 Statement of Corporate Intent (SCI), which describes our strategy for meeting the obligations outlined in our Statement of Core Purpose. Every three years, NIWA's Board and Executive undertake a complete refresh of NIWA's organisational and science strategy. This SCI reflects the review undertaken this year and reaffirms NIWA's commitment to delivering quality science for the nation's benefit in collaboration with others, continuing to invest in our people and assets, and sustaining our financial performance.

Not forsaking the high degree of economic uncertainty brought about by the impacts of COVID-19, over the period of this SCI we foresee an operating environment of significant opportunities for NIWA, because the nation's need for freshwater, climate and ocean science has never been greater. One of the biggest opportunities (and challenges) lies in the rapid advances in digital technologies that are increasingly altering the way science is done, what is possible, how it is communicated and used by others, and the staff capabilities and capital investments required. Our digital strategy in recent years has ensured we are well-positioned, and this SCI outlines how we will apply and integrate this capability into our science.

NIWA's strategic priorities in freshwater, climate and ocean science outlined in this SCI have been refreshed to ensure they are well-aligned with current Government priorities. The focus of our science is to:

- Provide industry opportunities.
- Help transition to a low carbon economy.
- Adapt to a changing climate.
- Improve the health of our waterways and oceans.
- Care for our unique biodiversity.

We will ensure we have the appropriate assets and expertise required to deliver our science. Over the past 10 years NIWA has made strategic investments in improving its assets and capabilities. These have included significant investments in state-of-the-art science equipment, IT infrastructure, the High Performance Computing Facility, upgrades to ocean-going research vessels, and increasing staff salaries to market competitive levels. Advancing NIWA's Future Property Programme (FPP), as outlined in this SCI, will continue this series of investments by bringing the Company's properties up to contemporary standards. In planning for the NIWA and the nation's economic recovery from the impacts of COVID-19, NIWA's Board and Executive are committed to continued strong financial performance to ensure we can make these necessary investments.

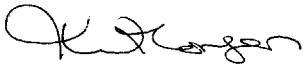
Three Cray supercomputers make up the High Performance Computing Facility. Together they are capable of processing more than two thousand trillion calculations per second. *[Dave Allen]*

One of NIWA's key focuses is to provide the science to help New Zealanders manage the transition to a sustainable future. Our Organisational Sustainability Charter outlines the principles and practice under which we operate, and we will refresh them to align with the UN Sustainable Development Goals and the NZ Treasury Living Standards Framework. We will be transparent about our environmental footprint, outlining SMART goals and targets, while remaining customer- and stakeholder-focused.

Over the coming year NIWA will implement initiatives to build resilience to, and advance national recovery from, the impacts of COVID-19. These will require short- to medium-term changes to our science, people, operational and financial management.

Within the refreshed strategy described in this SCI, we will:

- prioritise our research on the application of our knowledge, expertise and services to help accelerate the recovery of the nation's economy. This will focus on sectors of Government priority; namely, primary production, tourism, infrastructure, manufacturing and technology;
- continue to support the Government's on-going commitment to its strategic priorities associated with our changing climate, environmental health and sustainability;
- continue to provide input into evidence-based policy development by central and local Government through commissioned reports, membership of expert technical advisory groups and agency secondments;
- work collaboratively across all platforms to enhance the application of research and applied science services to the benefit of all New Zealanders;
- work with whānau, hapū, iwi and Māori enterprises to sustainably develop their resources and businesses in accordance with the Government's Vision Mātauranga and respecting the obligations to Māori by Government through Te Tiriti o Waitangi;
- recognise potential changes in workforce needs and preferences, and continue to provide a healthy, safe, flexible and diverse workplace;
- build the expertise we will need to support our response to COVID-19, while also meeting our longer-term strategy;
- ensure our staff adapt to new ways of working, especially in relation to travel and maintaining our networks of national and international collaborators, and invest in our IT systems so they can meet the increasing need for digital connectivity;
- reduce costs as a result of the anticipated significant decline in revenue to ensure that we can make the returns we need to be financially sustainable and deliver our future investment strategy.



Barry Harris
Chair

John Morgan
Chief Executive

NIWA's core purpose and key outcomes

NIWA's purpose is to enhance the economic value and sustainable management of New Zealand's aquatic resources and environments, to provide understanding of climate and the atmosphere and increase resilience to weather and climate hazards to improve safety and wellbeing of New Zealanders.

Outcomes

NIWA will fulfil its purpose through the provision of research and transfer of technology and knowledge in partnership with key stakeholders including industry, government and Māori to:

- increase economic growth through the sustainable management and use of aquatic resources
- grow renewable energy production through developing a greater understanding of renewable aquatic and atmospheric energy resources
- increase the resilience of New Zealand and South-West Pacific islands to tsunami and weather and climate hazards, including drought, floods and sea-level change
- enable New Zealand to adapt to the impacts and exploit the opportunities of climate variability and change and mitigate changes in atmospheric composition from greenhouse gases and air pollutants
- enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity
- increase understanding of the Antarctic and Southern Ocean climate, cryosphere, oceans and ecosystems and their longer-term impact on New Zealand.

NIWA Science Strategy

NIWA's mission is to support the wellbeing of Aotearoa New Zealand's people and businesses through improved management of the environment, sustainable use of natural resources, and effective responses to global change.

Our refreshed long-term strategy aims to deliver the science that will enable Aotearoa New Zealand to meet its environmental challenges and thrive in a rapidly changing world. We will innovate, generate new knowledge, and apply our science to transition to a low carbon economy, adapt to a changing climate, maintain healthy waterways and oceans, and to care for our unique biodiversity. To achieve these advancements, we will partner with Māori, embrace new technologies, and support major science infrastructure. We will collaborate with other science organisations and the sectors that apply our science products and services. These national outcomes and overarching approaches are described below.

The global COVID-19 pandemic has changed the needs of New Zealand. The negative impact of COVID-19 on our primary industries has been minor relative to other sectors, such as tourism. The primary sector will, therefore, be a major contributor to economic recovery, and the government is seeking to increase its sustainability and diversify its product base. There is also a need to revitalise the tourism sector. These needs are especially important for Māori because of their significant assets in tourism, fisheries, forestry, agriculture and horticulture. Whānau, hapū, iwi and Māori enterprises are actively seeking opportunities to sustainably develop their resources and businesses. We have, therefore, reprioritised some of our planned 2020/21 activities to ensure we can provide the expertise and services required to accelerate New Zealand's economic recovery and aid adjustment to any post-COVID-19 societal challenges.

National Outcomes

The primary focus of government in the near to medium term will be response to the disruption and longer-term domestic and international changes caused by COVID-19. While it aims to accelerate economic recovery, it is also seeking to advance the goals it set before the pandemic. These include regional economic growth, diversifying the economy, transitioning to a low carbon economy, improving water quality and achieving social equity. NIWA's science will support the realisation of these national outcomes.

NIWA has New Zealand's largest team of freshwater scientists who work to enhance the stewardship of our freshwater ecosystems and their biodiversity. Lake Matheson, West Coast. *[Rob Murdoch]*

Providing industry opportunities

Advancing sustainability

The availability of NIWA's high resolution spatial and temporal environmental data, data management systems, world-renowned data analytical and modelling expertise and survey technologies provides opportunities for the primary sector to mitigate environmental risk more effectively and make better business decisions. This not only applies to land-based farming activities, but also to the management of our fisheries. New Zealand's key fisheries are monitored and managed through the Quota Management System, and most are fished at sustainable levels or have rebuilding strategies in place. New and improved tools for monitoring target and secondary fish species and species interactions, as well as understanding the role of a changing environment on fish productivity, would enhance the sustainability of our fisheries.

To support sustainable practices and better management and operational decision making within the primary sector, NIWA will:

- Provide new high resolution environmental forecasting products based on novel sensor technologies and making use of the Internet of Things; enhance modelling and data analytics to reduce environmental impacts and de-risk decision making of land-based activities.
- Partner with Māori and industry to provide seasonal to decadal climate projections designed to inform future land-use options and investment decisions.
- Enhance fisheries management by developing new tools to monitor fish populations and ecosystems, including new, non-destructive survey technologies.
- Improve fish population assessment methods to determine the status of current and future stocks.
- Further develop technologies to reduce the adverse impacts of fishing on bycatch and marine habitats.
- Enhance machine learning tools for fish ageing and fish identification from onboard and underwater cameras.
- Improve our knowledge of the role of benthic habitats and climate change on fish distribution and productivity.

NIWA scientists have been surveying the hoki fishery since 1995, providing vital population information used to determine total allowable catch. *[Rebekah Parsons-King]*

Growing regional economies

There are significant opportunities to grow regional economies through the development and uptake of tailored products and services. New measurement technologies, data science and improved weather, climate and other environmental predictions provide opportunities to identify potential new products and increase industry efficiencies and market positioning, especially in the primary production, tourism and energy sectors. Application of these advances in partnership with Māori has potential to provide significant benefit to whānau, hāpu and iwi actively seeking to grow and expand their businesses.

To support regional economic growth of climate sensitive sectors NIWA will:

- Develop services based on new data analytics and models to combine environmental data and forecasts with third-party data to increase profitability by sectors impacted by weather and climate (finance, primary industries, infrastructure, energy, tourism and others).
- Inform regional planning regarding land-use diversification, based on future climate projections, soil types and transport links.
- Develop new weather and climate derivatives to inform production levels, supply chain management and sales forecasting, especially for the energy, retail and primary sectors.
- Help regenerate the New Zealand tourism sector by co-developing new information and environmental forecasting technologies to improve tourist operator planning, operational efficiency and safety management, and enhance visitor experiences.
- Add value to the manufacturing sector by co-developing technologies to better predict, and respond to, climate- and weather-related risks in supply chains.

Kingfish grown at NIWA's Northland Marine Research Centre can reach a marketable size of 3.5kg within 12 months. *[Crispin Middleton]*

Diversifying aquaculture

To date, the aquaculture sector has not been able to fully respond to the rapid growth in global demand for premium aquaculture products because of complex social licence issues, consumer expectations and, more recently, environmental change. It is currently dominated by sea-based farming of relatively low-value species and has suffered over recent years from climate-related declines in production. Onshore aquaculture represents a significant opportunity to overcome these issues and create new exports, regional economic growth, and business and employment opportunities for Māori. Onshore aquaculture avoids most current coastal regulatory impediments and can be insulated from climate change. It is now a financially viable production option given recent technology advances and the introduction of new high-value species.

To advance and diversify New Zealand's aquaculture sector, and support and complement established farming activities, NIWA will:

- Commence commercial-scale trials of yellowtail kingfish grow-out using a recirculating aquaculture system (RAS) to demonstrate the financial viability of onshore aquaculture.
- Maximise the quality and production of yellowtail kingfish and hāpuku through ongoing development of broodstock.
- Strengthen New Zealand's shellfish industries by developing tools and techniques to improve the productivity of greenshell mussel and oyster farms.
- Progress commercial culture of species of specific importance to Māori.

Allocating water better

In many New Zealand catchments, water allocation is approaching or has exceeded regulatory limits. Water abstraction for irrigation, potable supplies and other uses has increased substantially, as has knowledge of minimum river flow levels needed to sustain aquatic ecosystem health. As a result, competition among water users (including aquatic ecosystems) is steadily increasing, making the inequities of current water allocation systems increasingly apparent. These inequities are caused by first-in, first-served consenting and an inability to reallocate water in response to changes in water availability and demand. Five major changes are needed to rectify these inequities: dynamic and adaptive allocation (possibly through water trading), increased efficiency of water use, rigorously tested procedures for prescribing environmental flows, recognition of all legitimate water uses (including provision for 'cultural' flows), and policies and capability building that enable Māori to exercise their rights and interests in water.

To provide the evidence base to support policy makers and water managers responsible for making these changes, NIWA will:

- Develop simulation tools to assess the consequences of current water use, planned water allocation, and changes in water demand, availability, and quality as a result of climate change.
- Further develop the New Zealand Water Model to provide operational flow forecasting.
- Develop new technologies and data analytics to access, collate, quality-control and analyse data on actual water use, availability, and consents.
- Improve methods for water accountancy, especially in large, multi-use, multi-industry catchments.
- Develop tools to increase water use efficiency, including irrigation schedules based on soil moisture sensors and weather forecasts.
- Develop predictive models that relate river biota (periphyton, invertebrates, fish and birds) to flow variation.
- Work with iwi partners to develop methods for defining cultural flows informed by mātauranga Māori and include them in allocation frameworks.
- Work with iwi partners to investigate water resources and potential uses (after the needs of the rivers have been met).

An irrigation channel in Canterbury. With demand for water increasing, more farmers are looking at water storage to ensure reliable supply. *[Dave Allen]*

Transitioning to low carbon

Supporting a just transition

NIWA is well positioned to support New Zealand's transition to a low carbon economy. The Climate Change Response (Zero Carbon) Amendment Act requires this transition to be enduring, equitable and just. Actions to reduce emissions or adapt to climate change may negatively impact some sectors of society more than others. Therefore, the potential negative consequences of change will need to be assessed, evaluated and reduced. This will require transformative and novel engagement processes, scenario modelling, and assessment of multi-factor and cascading impacts. Transitions are complex and take time.

To support a just transition through transdisciplinary approaches across the science-policy-society spectrum, new collaborations and novel ways of thinking, NIWA will:

- Collaborate with Māori partners and stakeholders to co-develop transition research programmes, citizen science projects, easy-to-use decision-support tools and implementable plans designed to instigate behavioural change and produce low emission solutions.
- Work with government, industry, teachers, students and whānau to measure and understand sources and pathways of greenhouse gases.
- Work closely with Māori and Pacific Island communities to better understand the risks to their livelihoods and wellbeing associated with potential unintended consequences of change.
- Communicate the science of climate change, its potential impacts, and adaptation and mitigation options in clear, accessible and engaging ways across multiple media and channels and by using novel techniques tailored to the needs of specific groups.

Exploiting our renewable energy sources

The demand for electricity and other forms of renewable energy is projected to rapidly increase over the coming decades as our transport and industrial sectors decarbonise. To meet New Zealand's 2050 zero-carbon goals, we need to double the generation of electricity without using fossil fuels. In this future, most of our energy will come from rivers, wind, sun, and the ocean. Decision makers, whether they are government, generators, lines companies or communities, will need accurate, detailed and timely information about these renewable energy sources in a form they can use. It will need to support sub-hourly power management through to long-term planning of future technology and capacity, over scales ranging from national to off-grid communities and households.

The Clyde Dam – about 80% of our renewable energy is from hydropower, but all power generators and lines companies need accurate, detailed and timely information. *[Alan Blacklock]*

To provide the resource information required to increase the generation and use of renewable energy, NIWA will:

- Deliver custom datasets for electricity generation and optimisation by measuring, modelling and forecasting weather, river flows, climate variability and ocean conditions to allow predictions of renewable energy generation and transmission.
- Provide bespoke tools and data to assess present-day and future renewable energy supply and demand to support planning and decision making.
- Minimise or eliminate potential ecological and environmental impacts associated with renewable energy generation by applying enhanced understanding of biophysical and ecological processes.
- Quantify New Zealand's marine geological and ocean energy resources.
- Develop innovative methods to extract energy from ocean currents, tide and waves.
- Work with Māori and Pacific Island communities to design and manage small-scale, multi-source power generation schemes for self-sufficiency, resilience and economic benefit.

Mitigating greenhouse gas emissions

The greenhouse gas emission reductions required for New Zealand to meet its commitments under the Paris Agreement are now law, under the Climate Change Response (Zero Carbon) Amendment Act. New Zealand has an unusual emissions profile, and our path to reducing emissions is likely to be different to that of most other developed countries. We have a high proportion of agricultural greenhouse gas emissions, and the carbon that is absorbed as our forests grow offsets about 30% of our total greenhouse gas emissions. Quantifying carbon cycling in our forests and other terrestrial ecosystems is, therefore, critical, but it is not well understood. The carbon mitigation potential of urban land management, forest restoration, afforestation, and pasture soils must be measured to enable land management decisions that reduce, not exacerbate, greenhouse gas emissions. This is especially important because the agriculture sector recently agreed to design and implement an emissions reduction scheme at farm scale. This would be a world-first, but it will require innovative technological and scientific solutions, detailed multi-sensor observations and modelling, and deep collaboration across the agriculture industry, Māori, and government for it to succeed.

To help quantify and verify greenhouse gas mitigation initiatives, NIWA will:

- Measure and model isotopic variants of trace gases to determine local to global sources and sinks of greenhouse gases.
- Develop and validate methods for measuring agricultural emissions of greenhouse gases, from global to farm scale, to identify opportunities for reduction and inform policy.
- Maintain and globally disseminate high precision, long-running measurement series of key atmospheric parameters, such as greenhouse gases, vital to understanding the drivers of climate change.
- Make surface-based atmospheric column measurements to monitor trends in climate-active compounds and to validate satellite-based greenhouse gas measurements that support domestic and international monitoring of atmospheric change.
- Assess the effectiveness of proposed and implemented policy or management measures for reducing greenhouse gas emissions or sequestering carbon, including potential climate intervention options.
- Partner with Māori, government, business and national and international research institutions to quantify greenhouse gas reduction co-benefits associated with other environmental policies and actions, such as improving air and water quality and restoring degraded environments.

Adapting to a changing climate

Planning for climate change

Appropriately responding to present-day and future impacts of a changing climate is one of the greatest challenges of our time. Relationships between temperature changes, wind patterns, sea-level rise, ocean acidity, rainfall and snowfall, glacier and polar ice-sheet mass balance and their effects on our rivers,

groundwater and coasts are complex and dynamic. The potential impacts of these changes on our biodiversity, taonga species, productive and natural systems, water and food security, air and water quality, human and animal health and built environments are just emerging. How these impacts will affect our cultural heritage, economy, social structures, governance, Pacific neighbours, international relations and trade are still poorly understood. NIWA's ongoing research on changes in climate and its impacts will, therefore, be fundamental to New Zealand's ability to strengthen its adaptive capacity and long-term resilience to global change.

To provide the guidance and expertise required by New Zealand decision makers to respond and adapt to the impacts of climate change, NIWA will:

- Develop improved high resolution projections of climate and ocean state, including extremes, on timescales from months to a century. This will be achieved through state-of-the-art modelling (of the earth system, regions, and hydrological cycling) and data analytics on NIWA's high performance computer.
- Determine the role of the Southern Ocean in the global climate system by characterising the magnitude and variability of climate-related parameters and processes in the ocean and atmospheric marine boundary layer.
- Better understand the impacts of climate change, including the frequency and magnitude of heavy rainfall, sea-level rise and flooding, through enhanced process understanding and big data analytics.
- Apportion the relative contribution of anthropogenic climate change to historic and recent extreme events, such as floods, marine heatwaves, and droughts.
- Understand the downstream impacts of a changing climate on other biophysical systems, in collaboration with local and international experts.
- Enhance understanding of the impacts of changes in ocean transport on marine ecosystems and biodiversity.
- Produce government guidance and tools for better decision support regarding planning for climate change.
- Work closely with Māori and our Pacific partners, government and stakeholders to better characterise their climate change exposure and changing risks.
- Develop frameworks for engaging with affected parties and enabling adaptation, including assessment of financial and wellbeing implications and the development of evaluation tools.

The ability to forecast hazardous events is rapidly evolving with access to high performance computing, big data and machine learning techniques. *[Stuart Mackay]*

Improving resilience to natural hazards

Natural hazard risks around the world are increasing, primarily due to population and asset growth and the increasing frequency and severity of climate- and weather-related hazardous events. The National Disaster Resilience Strategy dictates proactive management of adverse risks and the building of resilience in New Zealand to natural physical hazards. This requires increased preparedness in New Zealand and the Pacific Islands to weather, climate and coastal hazards, along with air pollution, drought, severe tropical storms, storm surge/waves, erosion, tsunamis arising from earthquakes and underwater landslides, floods, and sea-level rise. The ability to forecast these hazardous events and risk is rapidly evolving through access to high performance computing, big data and machine learning techniques. These forecasts are essential for society to be able to prepare for and mitigate the impacts of future hazard events.

To provide, in real time, decision-relevant data on natural hazards to our Māori partners and stakeholders via bespoke forecasts and data services, NIWA will:

- Deliver and maintain its 24/7 operational multi-hazard forecasting system.
- Advance the next generation of high resolution weather forecasting models and the hazard models they inform, to produce higher-quality forecasts of localised flash flooding, national-scale coastal and river floodplain risk exposure, droughts, storms, seabed-generated tsunami from earthquakes and underwater landslides, and air pollution.
- Refine our knowledge of the underlying processes associated with hazards to improve the tools and guidance required by agencies, businesses, Māori and individuals to mitigate weather and climate hazard impacts.
- Enhance the RiskScape model to enable its use and application by national and Pacific Island users to estimate, plan for and manage future hazard risks.
- Work closely with international scientific organisations, especially the United Kingdom Met Office through the global Unified Model Partnership, to significantly contribute towards and harness leading-edge advancements in weather, climate and hazard modelling.

Reducing adverse effects of climate change

Climate change and associated sea-level rise and ocean and freshwater acidification adversely affect New Zealand's aquatic ecosystems. These environmental changes can have synergistic impacts, such as the effects of sea-level rise and increased storm surge on coastal wetlands, increasing sea temperatures and acidity on shellfish or increased drought and lower river flows on fish migration. These complex cascades make predicting, preventing and ameliorating adverse impacts challenging. Meeting these challenges requires improved understanding of environmental-change cascades, and incorporating that understanding into predictive models and tools that enable the development of measures to counteract or reverse any adverse effects.

To reduce the adverse impacts of climate-related changes to our aquatic ecosystems, NIWA will:

- Improve hydrological models to predict the impacts of climate change on the dynamics of surface and groundwater storage and flows, and combine this with the impacts of land-use change, such as afforestation.
- Develop models to predict river and lake water temperature responses to global warming, and develop guidelines for the use of riparian planting and environmental flows to counteract increasing water temperatures.
- Improve understanding of the cascade of changes linking climate drivers to erosion and runoff, river sediment loads, sediment accretion in estuaries, and the effects of sea-level rise on this cascade.
- Predict the effects of sea-level rise on coastal freshwater ecosystems and infrastructure, and the interactive effects of sea-level rise and land subsidence.
- Research and predict the separate and interactive effects of human activities, such as land use and extractive industries, and climate change on aquatic ecosystems.
- Examine the ecosystem effects of acidification on marine primary production, food quality, key habitat availability and biotic communities, including in Antarctica.
- Investigate sensitivity and resilience to predicted levels of ocean acidification of different life stages of economically important fish and shellfish species to inform population forecast models.
- Predict changes in the establishment, spread and impact of aquatic non-indigenous species under changes in climatic conditions that alter their habitat, potential ranges, population growth and behaviour.

Improving the health of our waterways and oceans

Reversing decline in water quality

Soft engineering structures, such as riparian strips, must be tailored to each site to maximise contaminant reduction. *[John Quinn]*

Water quality degradation is one the highest-priority environmental issues for New Zealanders. Recent NIWA research indicates that contaminant levels are elevated, and ecosystem health indicators are reduced in many rivers, lakes, estuaries and coastal areas. This research has also linked water quality degradation to land-use intensification, and water quality improvement to mitigation measures such as riparian planting and effluent diversion to ocean outfalls. Recent government policies have set out multiple water quality and aquatic ecosystem health objectives. Achieving those objectives will require a mix of mitigation measures and preventative steps, such as land-use change and water-sensitive urban design. However, these approaches are costly, so stakeholders need assurance that they will be effective.

To provide the effective preventative and mitigation measures required to improve New Zealand's water quality, NIWA will:

- Develop a range of modelling tools to predict contaminant generation on land, its transport to freshwater and marine ecosystems, and its ecological and cultural impacts in those ecosystems. These tools will range from simple dilution models for estuarine water quality to complex distributed models of catchment processes.
- Develop tracer technologies to identify contaminant sources, including geochemical, isotopic and radionuclide tracers and mixing models.
- Quantify the occurrence and distribution of microplastics in the marine environment.
- Design, implement and test contaminant mitigation systems, such as riparian buffers and detention bunds, constructed wetlands, lake sediment capping and aeration, bioreactors and bioremediation, restored shellfish and seagrass beds and other soft-engineering structures.
- Design, implement and test cost-effective wastewater treatment systems, including pond and wetland systems for marae, papakāinga and primary production systems.
- Develop operational forecasting systems to inform the public about recreational water quality before exposure.

Ecosystem based approaches to resource use

Ecosystem Based Management (EBM) is a strategy for the management of natural resources that recognises the full array of interactions within an ecosystem, including human. It promotes both sustainable use and conservation in an equitable way. New Zealand's marine and freshwater ecosystems are subject to a wide variety of competing uses, such as fishing, recreation, transport, tourism, aquaculture and cultural uses, only some of which are well monitored and managed. EBM differs from current management strategies by considering all activities that affect the environment, rather than managing individual species or sectors.

To provide the environmental science evidence required to implement ecosystem based approaches to the management of our aquatic resources, NIWA will:

- Enhance understanding of the environmental and biological drivers and fate of primary production in estuarine, coastal and oceanic areas over multiple time and space scales.

- Develop coupled models that link catchment land use to contaminant (e.g., sediment, nutrients, metals) loss, transport, and input to aquatic ecosystems.
- Improve physical, ecological and spatial modelling tools to better understand key system processes and interconnections, including the role of benthic habitats and functioning of pelagic systems, to inform management and protection of New Zealand's marine estate and Antarctica.
- Advance biological and ecological knowledge of target and bycatch species to enable an ecosystem approach to fisheries management.
- Develop ecosystem-aware tools to support kaitiakitanga and decision makers that can deal with cumulative effects and uncertainty and focus on translating impacts on ecosystem components to impacts on human values (cultural, social and economic).
- Develop new mātauranga-embedded cultural assessment approaches that contribute to EBM, in a manner consistent with tikanga-ā-iwi, to assist Māori in their natural resource decision making and co-management.
- Develop methods to predict both degradation and the potential for recovery of aquatic ecosystems, especially with communities actively engaged in rehabilitation initiatives.

Measuring the state of our environment

Regular measurements of the state of our atmosphere, water ways and oceans inform the sustainable management of natural resources and climate adaptation planning. They are also essential for assessing the physical and ecological health of our aquatic environments and their ability to deliver the ecosystem services required to support biodiversity and resources such as fisheries. To measure the state of our environment effectively requires extensive monitoring and modelling, and a recent review by the Parliamentary Commission for the Environment highlighted shortfalls in the consistency of current measurement and analysis methods for state of the environment reporting. It also identified the need for greater inclusion of mātauranga Māori and marine biodiversity measures.

Through partnerships with government departments, iwi, councils and other organisations that run monitoring programmes, NIWA will:

- Improve methods for field measurements, sample collection, sensor deployment (including via satellites) for environmental parameters that meet or surpass national and international standards.
- Develop, test and operate monitoring technology, including telemetered sensors, remotely operated vehicles, in situ analysers, and geospatial survey instruments.
- Monitor the variability and rate of change in marine temperature, pH and carbonate systems at sentinel sites around New Zealand.
- Maintain and extend NIWA-run observation programmes and data sets (including river water quality, freshwater fish and plants, hydroclimatic measurements, sea-level rise, bathymetry, glaciers, ocean pH and fisheries catch), ensuring best practice data management and accessibility.
- Further develop and test ecosystem health indicators, including new methods and integration of ecological, societal and cultural indicators.
- Improve data analysis and visualisation of environmental data in NIWA's products and services.
- Continue curation of internationally significant collections and samples, especially marine invertebrates, sediment cores and atmospheric gases.
- Provide predictions of environmental parameters for unmonitored locations, including rivers, lakes, aquifers, estuaries, coastal zones, the alpine region and oceans.

Caring for our unique biodiversity

Enhancing biodiversity protection

With about 410,000km of freshwater systems and a marine estate more than 21 times the area of our land, understanding New Zealand's unique biodiversity, how it is threatened and how best to protect it, is a major challenge for scientists and resource managers alike. Our biodiversity supports a wide range of native birds, plants, fish and animals that are highly significant to Māori. For Māori, the relationship between the health of our ecosystems, taonga species and the wellbeing of whānau, hapū and iwi are interconnected. Sophisticated biodiversity modelling approaches are needed to fill information gaps, and increased understanding of connectivity, resilience and recovery of marine and freshwater communities will be crucial for effective biodiversity protection measures.

Working with Māori to inform new approaches for the sustainable use, protection, restoration and co-management of taonga species. *[Stuart Mackay]*

To increase knowledge of our biodiversity and establish the spatial management tools needed to effectively mitigate threats to our ecosystems and the species they support, NIWA will:

- Predict and prioritise key ecological habitats and locations for the conservation of biodiversity and ecosystem integrity.
- Collect, identify and curate organisms from New Zealand's aquatic ecosystems, from the tropics to the Antarctic.
- Analyse field data to define key habitat associations and improve individual species and community distribution models, trophodynamic models and ecosystem models, and identify problematic information gaps.
- Develop innovative modelling approaches and spatial management tools that address knowledge gaps in biodiversity information.
- Improve understanding and quantification of population and ecosystem connectivity to increase our ability to predict ecosystem resilience and recovery.
- Develop new innovative approaches to ecosystem protection, monitoring and management, including Antarctic aquatic environments.
- Co-develop research priorities, methods, tools and products with whānau, hapū and iwi that inform new approaches for the sustainable use, protection, restoration and co-management of the environment and associated taonga species.
- Enhance understanding of the adverse effects of resource use, habitat and climate change and invasive species on biodiversity and taonga species, including protected species.

Restoring degraded aquatic ecosystems

Through a combination of land-based sedimentation and nutrient effects, compounded by physical and biological disturbance by anthropogenic activities, the freshwater, estuarine, and marine environments in many areas of New Zealand have been degraded. Key habitats have been lost. Degraded habitats result in compromised ecosystem services (e.g., nursery grounds, biodiversity, carbon sequestration, cultural and recreational use), and adverse impacts on valuable fisheries and aquaculture. The restoration of taonga species, degraded cultural values, and freshwater and marine socio-ecological systems are key elements of Te Tiriti o Waitangi settlements. Māori are seeking the knowledge and tools required to restore degraded ecosystems and associated taonga, at various scales, to provide for their intergenerational cultural, social, environmental and economic needs.

To develop effective tools and approaches to restore and rehabilitate degraded aquatic ecosystems, NIWA will:

- Identify and predict the responses of aquatic ecosystems to environmental stressors, including multiple interacting stressors.
- Improve knowledge of the links between land use and impacts on aquatic ecosystems.
- Define success for restoration activities in relation to social and cultural values and ecosystem services, and prioritise activities to restore degraded habitats.
- Develop indicators of aquatic ecosystem condition, including criteria for determining Key Ecological Areas and the link to the services they provide.
- Co-develop approaches that bring mātauranga Māori and other knowledge systems together to provide the information, tools and approaches required by Māori to restore aquatic ecosystems and their associated cultural values, uses and practices.
- Further develop tools to reduce the environmental impact of extractive industries such as fishing and mining.

Protecting aquatic environments from invasive species

Protection of our marine and freshwater environments from harmful organisms has been challenged by the growth and diversification of New Zealand's trade and tourism, changes in the pathways for the entry and spread of risk organisms, and pressures from established pests and diseases. Our changing climate is adding to this dynamism by providing opportunities for the emergence and establishment of new pests and diseases, and by driving changes in the distribution and impacts of existing pests. Incursions into our waterways impact a broad range of stakeholders, necessitating a partnership approach to management, surveillance, eradication and control. Māori have a unique interest in the biosecurity of our waterways through their role as kaitiaki, as treaty partners and through investments in fishing and aquaculture.

Remotely operated vehicle (ROV) technology can substantially improve biosecurity surveillance in hazardous and murky locations. *[Stuart Mackay]*

To strengthen international and domestic biosecurity partnerships, respond to climate change, and recognise the centrality of mātauranga Māori in New Zealand's biosecurity system, in line with the government's Biosecurity 2025 strategy, NIWA will:

- Work with and share research with our international partners, including Australia, Canada, the US and the Pacific, to understand emerging threats and develop consistent best-practice approaches to pathway management.
- Improve the sensitivity of surveillance of aquatic pests and diseases through development and application of new technologies and survey designs.
- Develop models to predict the future establishment, spread and impact of aquatic pests, as influenced by climate and land-use change, and changes in vectors and exclusion and control actions.
- Develop more effective technologies and strategies for eradication or control of established aquatic pests.
- Improve our understanding of the dynamics of aquatic diseases in relation to climate change and their potential impacts on production systems and aquatic ecosystems.

- Partner with whānau, hapū and iwi to support the use of mātauranga Māori and tikanga in the prioritisation of biosecurity risks, and in the design and development of tools for surveillance, response and pest management.
- Improve the availability and usefulness of biosecurity data and data products for decision making.

Embracing new technologies

NIWA aims to exploit innovative new technologies in our science and operations to ensure we can deliver the information, products and services the nation needs.

Globally, science is making revolutionary advances on the back of innovative new technologies. Radical improvements have been made and continue to occur in environmental sensing, satellite-based communications and earth observations, high performance computing, data analytics/AI, modelling, and presentation technologies like augmented reality. These provide insight into our environment and predictions of change that were unimaginable not so long ago. Application of these new technologies will be essential to solve the increasingly complex issues associated with natural resource use and environmental change. This will be especially important for growing our climate-dependent sectors, especially primary production, energy and tourism, reducing carbon emissions, and managing aquatic resources.

RV *Tangaroa* successfully deployed four new tsunami detection buoys off the east coast of the North Island as the first instalment of a 15-strong early warning network. *[Rebekah Parsons-King]*

NIWA has always been a developer and early adopter of new technologies. These have included high performance computing, precision environmental forecasting, real-time sensor arrays, remote sensing, big data analytics, and advanced isotope measurement. We have developed and maintain state-of-the-art environmental monitoring networks to measure atmospheric constituents, weather, river flow and water quality, ocean acidity and sea level; satellite receiving stations; a high-performance computing facility and data centre; and large environmental databases and aquatic organism collections. These not only support NIWA, but also a wide range of stakeholders.

In recent years, we have increased our focus on technological innovation and capability in NIWA, with the appointment of additional senior staff and better integration of our IT team and science operations. We have also established an accelerator seed fund and a programme to develop the digital capability of our staff.

To achieve our vision of a fully integrated, digitally connected, science pipeline from data collection through to delivery of our information, products and services, NIWA will:

- Continue to advance our Information Technology to ensure our systems remain secure, enable remote working and meet our operational and science needs.
- Further develop our remote sensing capability, both far-field and near-field, to increase the resolution and spatial extent of field observations.
- Assess the adequacy of our measurement networks to support new generation environmental modelling and forecasting systems.
- Initiate the development of new, high-density, field-sensing capabilities to provide the data required for enhanced environmental simulation or modelling.
- Expand and further develop new data analytics capabilities to complement existing deterministic models across all areas of science.
- Develop architecture for a new data facility to streamline and enhance big data management and processing and the delivery of data products to stakeholders.
- Complete the roll-out of the Digital Capability Development programme.

Investing in science assets

NIWA will invest up to $15 million annually to grow or refresh our technology, equipment and assets of national significance to ensure they meet New Zealand's future science needs.

NIWA owns and operates core national infrastructure on behalf of the wider New Zealand science system. This includes three key assets: the deepwater research vessel *Tangaroa*, the National Environmental Monitoring Networks, and the High Performance Computing Facility. NIWA also maintains nationally significant databases and collections, including the National Climate Database, the New Zealand Freshwater Fish Database, the NIWA Marine Invertebrate Collection, and the Water Resources Archive. NIWA has two additional key assets of international significance, the Northland Marine Research Centre and the Lauder Atmospheric Research Station.

In addition to RV *Tangaroa*, NIWA operates a smaller ocean-going vessel, RV *Kaharoa*, a fleet of inshore coastal vessels, including *Ikatere* and *Rangitahi III*, and about thirty other small certified boats. NIWA maintains specific state-of-the-art specialist facilities that include a Stable Isotope Analytical Facility, satellite receiving stations at Lauder, Maupuia and Greta Point, and equipment at Arrival Heights Atmospheric Research Laboratory in Antarctica. In addition to the four main sites in Auckland, Hamilton, Wellington and Christchurch, NIWA also has ten field offices across the country supporting our science.

NIWA's atmospheric research station at Lauder is one of five primary sites in the international Network for the Detection of Atmospheric Composition Change (NDACC). *[Dave Allen]*

To provide the science assets needed by NIWA and the wider science system, NIWA will:

- Provide voyage time on RV *Tangaroa* to science providers, including a voyage to Antarctica, and for fisheries stock assessments and the deployment of New Zealand's tsunami dart buoy network.

- Partner with the Ministry of Business, Innovation and Employment to undertake a review of New Zealand's longer-term research vessel needs and on-going support for RV *Tangaroa*.
- Design and cost a new replacement vessel for the aging RV *Kaharoa* and prepare a business case as appropriate.
- Continue to support the operation of the High Performance Computing Facility and provide expertise to the collaborative National e-Science Infrastructure initiative and contribute to development of a strategy to meet New Zealand's long-term high performance computing needs.
- Scope a 'mid-life' upgrade of our current High Performance Computing Facility to ensure it meets New Zealand's science needs for the next 5 years.
- Maintain our measurement networks and assess their adequacy to support new generation environmental modelling and forecasting systems.
- Complete the upgrade of the mass spectrometers in the Stable Isotope Analytical Facility.
- Design and construct a commercial-scale recirculating aquaculture system (RAS) for part or all of the production cycle of high-value finfish species.

Partnering with Māori

"Ki te pūwaha te tai nei, hoea tahi tātou"
"By paddling as one we can get the Taihoro Nukurangi canoe past the waves to calmer waters"

NIWA's aim is to have enduring partnerships with Māori to support kaitiakitanga and provide environmental research that enhances the social, cultural, environmental and economic outcomes for whānau, hapū, iwi, and Māori businesses.

Māori play an increasingly critical role in the co-governance and co-management of New Zealand's natural resources. They are proactively developing their own resources (human and natural) to improve economic prosperity, social wellbeing and environmental outcomes for whānau, hapū, and iwi.

By combining our scientific knowledge with Māori expertise in mātauranga Māori and tikanga Māori we can improve understanding and management of taonga species. *[Rebekah Parsons-King]*

Both local and central government are recognising the important contribution of mātauranga Māori, and the kaupapa-Māori research approach of co-innovation informed by tikanga Māori, mātauranga Māori and science working together. As such, the government's Vision Mātauranga science policy requires greater engagement, collaboration and partnerships with different levels of Māori society. This places significant pressure on Māori

research capacity and requirements for Māori engagement, and remains a significant challenge to the realisation of practical and sustainable solutions for Māori and New Zealand generally.

NIWA has a successful track record in working with Māori across climate, freshwater and ocean environments. Te Kūwaha, a unique team of NIWA researchers, help to combine our scientific expertise with their expertise in mātauranga Māori and tikanga Māori. They work at the interface of knowledge systems to generate fit-for-purpose methodologies, tools and products required by Māori as kaitiaki, resource owners, managers and decision makers.

To strengthen our partnerships with Māori, NIWA will build capacity in the Te Kūwaha team and grow their influence across the organisation. For our Māori partners this will ensure that: water quantity and quality provide for the cultural, environmental, social and economic needs of Māori; the capacity and capability of whānau, hapū, iwi and Māori businesses are strengthened to enable them to respond and adapt to climate change risks and impacts; and the health and wellbeing of taonga species, aquatic (freshwater and marine) environments, mahinga kai and Māori livelihoods are safeguarded.

To build collaboration with whānau hapū, iwi and Māori businesses NIWA will:

- Underpin our relationships with Te Tiriti o Waitangi principles of partnership, participation and protection.
- Ensure whanaungatanga (fostering relationships), kotahitanga (partnership), manaakitanga (reciprocity and generosity), and kanohi kitea (becoming a familiar face) are fundamental to how we do what we do.
- Empower Māori interests and mātauranga Māori by bringing knowledge systems together to inform their unique responsibilities as kaitiaki and managers of environmental resources.
- Co-develop research priorities, work together to undertake them and use Māori knowledge and methodologies where appropriate.
- Build science capability and capacity for the benefit of whānau, hapū, iwi and Māori businesses.

Working with others

NIWA's aim is to enhance our collaborations with Māori, other national and international science organisations and stakeholders to deliver excellent science that meets New Zealand's needs.

Multi-disciplinary science that covers the environmental, economic and social domains is fundamental to solving national and global environmental challenges. Advances in measurement technologies, data science and computing are providing new research opportunities for system-based solutions, and the development of new innovative science-driven tools and services for Māori and other stakeholders. The application of these advances requires strategic partnerships and collaborations bringing together expertise and technologies.

NIWA has a reputation for science excellence, and has been able to establish strong partnerships and collaborations with leading international research and technology

NIWA is one of five core members of the global Unified Model Partnership, working together in developing world-leading climate and weather forecasting technology. The signatories, including NIWA Chief Executive John Morgan (left), renewed the partnership at Te Papa last year. *[Dave Allen]*

organisations, local universities and the other Crown Research Institutes. Our delivery of relevant science has led to strong collaborations with Māori and the key sectors our science supports. We will use these relationships to:

- Ensure our science meets the needs of Māori, communities and the sectors we serve.
- Deliver knowledge, products and services derived from our research.
- Provide access to critical national science infrastructure we own and support.
- Develop the science capability the nation will need in a rapidly changing world.
- Contribute to and leverage the expertise, knowledge and technologies developed by others.

We will meet our goal by strengthening stakeholder partnerships and collaborations, including:

- Central and local government agencies as they develop policies associated with transitioning to a low carbon economy, adapting to climate change, improving water quality, managing aquatic natural resources and ecosystems, and growing regional economies.
- Māori researchers, tribal authorities and businesses to help build their research capacity.
- Key business sectors to better understand their issues and opportunities and work together on solutions.
- Crown Research Institutes in the areas we lead or contribute to.
- Universities to expand our research skills and help build capability, especially through our joint graduate schools.
- International weather and climate science organisations to improve the accuracy of weather forecasts and climate projections.
- BLAKE (The Sir Peter Blake Trust) to promote an awareness of the environment and the opportunities science provides.
- International science organisations involved in joint global marine and climate research initiatives.
- National e-Science Infrastructure parties to provide high performance computing.

Communicating for impact, uptake and understanding

NIWA's aim is to ensure that the knowledge our science develops is communicated to our stakeholders and society to inform policy and planning and better business and societal decision making.

Excellent science is fundamental to the sustainable management of our natural resources and a society that prospers in a rapidly changing world. But science is often complex, so we must inform our audience using a style and manner they can understand, readily access and easily use.

NIWA's audience is many and varied, but all need to better understand the disruptive and complex world we live in – from central and local government agencies making management and policy decisions, to climate-sensitive businesses that need accurate forecasts, and the general public seeking to better understand the impacts of our changing world. The social order is challenging – people demand that information and data are immediately available, and the rapid evolution of technologies is changing the way the message is delivered and received. Skilful communication reinforces our reputation as the provider of independent, impartial and authoritative science.

NIWA has invested significantly in its communications team and their resources to ensure we can meet this demanding scenario. This investment has ensured a high profile, with more than 100 media releases annually and a very active social media presence. This has resulted in an annual mainstream media audience of well over 70 million and a social media audience of more than one million. We also reach thousands of school and university students each year as the major sponsor of science and technology fairs nationwide, through the Sir Paul Callaghan Eureka Awards, as the Principal Science Partner of BLAKE, and by supporting Sea Life Kelly Tarlton's Aquarium.

We have a fully equipped studio and staff capable of producing sophisticated and tailored data visualisation to communicate our science. Output includes graphics and animations of weather modelling and observations for the presentation of tailored forecasts for clients, conveying long-term climate change projections, visualising changes in air quality, forecasts of river flows, or presenting bathymetric data. Seasonal Climate Outlooks and Pacific Island Climate Updates are filmed in the studio, as are many of our social media videos.

NIWA has an extensive, dynamic, and informative website that also functions as a library for hundreds of media releases and videos designed to tell our science stories in a simple, engaging style.

NIWA forecaster, Nava Fedaeff, fronts the media conference during the release of NIWA's annual national climate summary. *[Sam Fraser-Baxter]*

To meet its communications goal, NIWA will:

- Present the organisation as a primary authority and source of information in climate, freshwater and ocean science.
- Lead public engagement and understanding of the critical issues in these areas of science.
- Re-develop our communication and engagement with Māori to support greater uptake and use of the latest climate change science and guidance for Māori authorities tasked with planning and development in their communities post COVID-19.
- Enhance knowledge transfer and stakeholder uptake through the continual development of dynamic, highly visual imagery and innovative technologies and tailored stakeholder communications and engagements.
- Help with recovery of the tourism sector by translating our science into products that will enhance visitor experience.
- Remain agile, proactive and responsive in the rapidly evolving media environment.
- Stay committed to enhancing the understanding of the role and benefits of science and, in particular, fostering an interest in science among students of all ages.

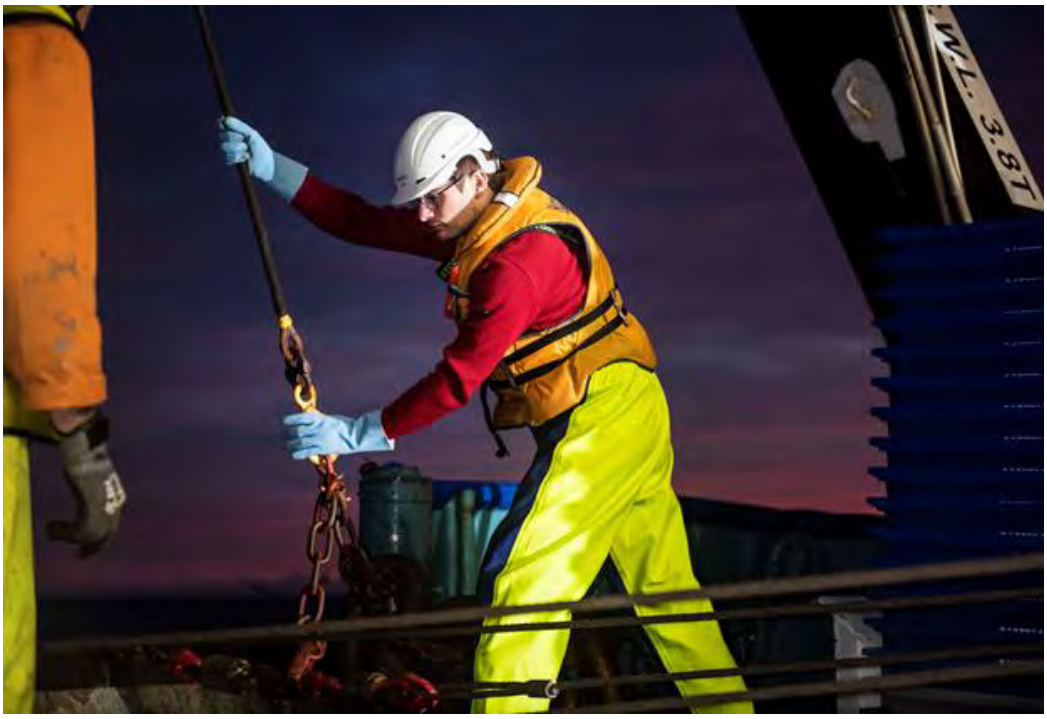
Our people

NIWA aims to provide a healthy, safe and productive work environment.

NIWA draws from an increasingly competitive international recruitment marketplace to support its high calibre science and enabling services workforce. Our reputation attracts the best candidates for our positions, and we seek to provide a competitive package of remuneration and benefits relative to the New Zealand general market. With societal changes and changing employee preferences, we need to ensure that our employment terms and conditions remain contemporary and relevant.

NIWA's recruitment and workforce planning processes are rigorous and assess the skill needs of our science and enabling services strategies, with a focus on understanding changing market demand, being opportunity-ready, and responding to future capability needs and succession. In today's environment of uncertainty and rapid change this ensures we are investing in people who are highly adaptable, have the capabilities to meet science, technology and support needs with contemporary knowledge, and can identify and act on emerging opportunities. We seek personal qualities and attributes consistent with our desired One NIWA culture and NIWA Values, including strong teamwork and collaboration, customer focus, agility, integrity, striving for excellence, and strong awareness of health and safety.

We provide a highly flexible, diversity-aware and family-friendly workplace, elements which are increasingly expected and valued by today's workforce. Enhancing diversity and inclusion has been an important cultural development focus for NIWA in recent years. NIWA has increased the Te Kūwaha team of Māori environmental researchers and associated staff, who assist in developing our bicultural organisational capability. Our long-standing commitment to equal employment opportunity and gender equity aims to provide a welcoming and inclusive environment for all staff (recent diversity and inclusion initiatives include a focus on Rainbow community inclusion, achieving the DVFreeTick, and providing training, guidelines and resources for staff on unconscious bias). We have also increased our focus on wellbeing, including mental health awareness, resilience to change, and preventing and responding to unacceptable behaviour at work.



NIWA Fisheries scientist Dr Yoann Ladroit on the trawl deck of *Kaharoa* during this year's hoki stock assessment survey. *[Rebekah Parsons-King]*

NIWA offers interesting, varied and challenging work, with opportunities for professional and personal growth and development over the long term, which helps retain and motivate our workforce. In addition, positive, effective leadership is essential for NIWA's "high trust, high delegation, high accountability" culture, which is caring and supportive of staff, while maintaining high expectations for their conduct and performance, and that of the overall organisation.

The health and safety of our people and others working with us is paramount at NIWA. We strive to achieve this through improving safety leadership, focusing on personal decision making, and pursuing excellence in our health, safety and wellbeing practices.

To continue to maintain a positive, nurturing, safe and progressive environment for our workforce, NIWA will support:

- Leadership development and succession to ensure we proactively grow current and future leaders.
- Staff to attend professional meetings, seminars, workshops and conferences to upskill, network, develop collaborative opportunities, and transfer knowledge or technology to stakeholders, with an overall investment in staff professional development of about $1.5 million per year.
- Joint Graduate Schools with the Universities of Auckland and Waikato, a Centre for Excellence with Otago University, and about a dozen NIWA staff who hold joint appointments with New Zealand universities.
- Building science capacity and capability through inclusion and co-supervision of more than 80 postgraduates within our science programmes and postdoctoral positions and by sponsoring science experts as visitors.
- Reviewing employment terms and conditions to ensure they remain relevant, attractive and competitive in the current market.
- Additional resources to ensure early career science staff and other staff at a point of challenge in their career have good quality individual development plans, including provision of mentoring when appropriate.
- Continuing to evolve our ability to make data-driven decisions to enhance our health and safety performance.
- Building clarity and consistency in health and safety training for our critical risk areas.
- Strengthening our focus on health and wellbeing in our approach to project management.
- Continuing to achieve organisational performance targets for collaboration, knowledge transfer, operational efficiency and on-time delivery.

Future property programme

NIWA aims to invest in its properties to ensure they are contemporary and will meet the future needs of our workforce and science.

NIWA owns or leases 23 sites around New Zealand, with locations chosen for proximity to the environments which it studies and to its customers. Most of these sites have either already been upgraded to contemporary standards or are the subject of projects already under way. The Future Property Programme addresses the needs of the Company's three most significant research centres, in Hamilton, Wellington and Christchurch.

In planning this programme, NIWA has carefully considered and responded to changes in the way in which science is undertaken. These 'new ways of working' are more flexible, collaborative and creative, while responding to the rapidly changing needs and expectations of a modern workforce. Responses to these changes include a move away from traditional individual offices to open workspace environments, with laboratories consisting of adaptable, multi-use spaces, rather than being dedicated to single functions.

The need for change at the three sites is compelling. Thorough investigations by NIWA and by external experts demonstrated that:

- Buildings are at the end of their useful life, are functionally obsolete and cannot support NIWA's science into the future.
- The sites and buildings, and their associated process flows, are dysfunctional and inflexible, compromising science delivery, safety, and the ability to respond flexibly to changing future requirements.
- The sites are unappealing, dated and of low quality; they do not appropriately reflect NIWA's values (including sustainability and an ongoing partnership with Māori) and nor do they convey an appropriate image to NIWA's stakeholders.

In short, without significant investment in modernising NIWA's properties, continuity of business operations cannot be assured beyond the short term. The sites would also fail to support the evolving needs of contemporary science.

Three overarching investment objectives have been identified for the programme. These are to:

- Protect NIWA's ability to deliver its science for the foreseeable future.
- Promote efficient and effective science operations, ensure the safety of staff and visitors, and ensure that NIWA can respond flexibly to changing future needs.
- Properly reflect NIWA's values, including sustainability and an ongoing partnership with Māori, and convey an appropriate profile to all stakeholders.

An Investment Logic Map has been developed for the programme which links problems with the current state with the benefits intended from the programme. A series of measures and targets has also been developed, against which the programme's delivery can be assessed.

After thoroughly reviewing available options to deliver the programme's investment objectives, NIWA has decided to undertake the following developments:

- Redevelop NIWA's existing site at Greta Point in Wellington, with all-new laboratory and office facilities, and renovated storage buildings.
- Construct an all-new research facility in Hamilton, replacing the existing facility on the University of Waikato campus. NIWA will remain on the university campus, and we have agreed a suitable new site.
- Construct an all-new research facility in Christchurch. Options for its location remain under investigation.

The combined cost of the three developments is estimated at $170 million. As discussed elsewhere in this SCI, this investment will be funded from NIWA's own resources and debt, with no Crown funding being required.

The Company has completed the Concept Design and Preliminary Design phases for all three sites. These enabled the development of the programme's Single Stage Business Case, which received the support of shareholding Ministers in November 2019. The Developed Design phase is currently under way for the Wellington and Hamilton sites. (This phase will be undertaken for the Christchurch facility once the site selection decision has been finalised.)

NIWA will advance preparation of the Detailed Design phase for Wellington and Hamilton to achieve "shovel-ready" status as soon as possible. It is hoped that construction of all three facilities will be completed by the end of 2024.

Architect illustrations of NIWA's proposed new offices in Wellington (top) and Hamilton (bottom).

A financial approach that enables delivery

As a Crown Research Institute, one of NIWA's fundamental operating principles, set out in its Statement of Core Purpose, is that it must run in a financially sustainable manner. This means that in addition to securing enough revenue to fund day-to-day expenses, it must generate sufficient cash flow to ensure that it can continually invest in maintaining and upgrading the assets that NIWA requires to support its science mission for the long term.

This focus on maintaining and upgrading key science assets is especially critical for NIWA because its areas of science expertise require state-of-the-art scientific equipment as well as several large assets, such as its High Performance Computing Facility, its marine research vessels, and its office and laboratory buildings. Ensuring that NIWA is in a position to deliver on this requirement requires careful planning. These plans must be continually reviewed in the light of changing circumstances and modified as required to ensure that the organisation's financial sustainability is protected for the long term and NIWA can continue to deliver on its science mission on behalf of the nation.

NIWA maintains a Long Term Financial Plan with a ten-year horizon. The revenue and cost assumptions in this plan reflect a prudent view of NIWA's financial outlook, consistent with those reflected in this Statement of Corporate Intent for the coming five years. The plan identifies NIWA's anticipated investment needs over the next ten years and the operating and financing cash flows necessary to fund them.

Underpinning NIWA's approach to financial planning is the way it manages its operations to deliver financial performance in the short term and financial sustainability in the long term. This involves a close focus on delivering the margins necessary to ensure the delivery of sufficient operating cash flows to support its long-term investment plan. NIWA achieves this through a rigorous approach to project management, with all its science activities, whether research or applied science, being managed through its project management and accounting system. This enables all NIWA's research and applied science work to be closely managed to ensure its completion within budget, and thereby the delivery of the margin objectives.

The Finance, Procurement and Legal function supports and enhances NIWA's organisational health and financial sustainability by delivering the following four outcomes:

- Effective processes which 'just happen'.
- Insight to guide decision making.
- A source of trusted professional advice.
- Properties fit for world-class science.

The Finance, Procurement and Legal function has the following key objectives:

- Financial accounting and external reporting will be delivered on time, free from material error and as efficiently as possible.
- Financial and administrative operations will be effective, efficient and well controlled, while allowing seamless interaction with our customers, suppliers and staff.
- Management reporting and financial analysis will be insightful, intuitive and well positioned to support agile decision making at all levels of the organisation.
- Risk management activities will help all areas of the business prosper by ensuring that risks are managed to an acceptable level while facilitating an agile and responsive operating environment.
- Property upgrades will be consistent with an overarching property strategy that ensures that all NIWA's properties are of a contemporary standard and closely align with its future needs.
- Internal audit activities will identify opportunities to improve systems and processes while providing assurance to the Executive and Board that risks are being appropriately managed.

Financials

The financial assumptions reflected within this SCI are characterised by a high degree of uncertainty. At the time of their preparation, during May 2020, it is not yet clear what the impact of the global economic recession will be on the ability of our primary customers and stakeholders to fund our work. In particular, the priorities of central and local government, and their ability to fund those priorities, is evolving rapidly. We expect them to become clearer over the next several months to a year, and in the meantime the projections reflected in this SCI may be subject to significant change.

NIWA has developed a financial plan for the period set out in this SCI which we consider to be balanced. It reflects prudently conservative expectations that can both accommodate a level of downside risk should the economic context remain challenging for longer than expected, while also offering opportunities for out-performance. Importantly, the financial plan includes $8.27M COVID-19 Response and Recovery Funding (CRRF) provided by the Government in each of 2019/20 and 2020/21. We welcome this additional funding as a demonstration of the Government's recognition of the important role CRIs have in addressing the economic and social impacts of COVID-19. This funding will be fundamental to our ability to protect important planned investments in the Company's science and other assets, as well as to maintain current levels of capacity and capability.

The three-year financial plan reflects an expectation of limited revenue growth following a material reduction in underlying revenue (before accounting for the CRRF amount noted above) forecast for 2019/20. Operating costs will be tightly controlled. The budgeted Group revenue for 2020/21 is $159.8M, with total costs of $150.5M, creating an operating surplus before tax (EBIT) of $9.3M and an adjusted return on equity of 6.0%. NIWA expects to continue to deliver strong operating cash flows, with a budgeted EBITDAF of $31.4M in 2020/21.

Revenue

In 2020/21 NIWA Group revenue is budgeted at $159.8M, after accounting for $8.27M additional CRRF money. This reflects an increase of $0.3M compared with the forecast for the 2019/20 year but a reduction of $5.5M compared with the level contemplated by last year's SCI. Compared with the prior year forecast there is an increase in research revenue driven by the carry-over of work unable to be undertaken during the second half of 2019/20 due to the COVID-19 pandemic, as well as due to the re-phasing of National Science Challenge (NSC) work. Most of the NSC-related revenue increase relates to work undertaken by collaborators on the two challenges that NIWA hosts, and so is largely offset by an increase in sub-contractor expense.

We expect the increase in research revenue to be offset by a decline in commercial revenue in 2020/21, reflecting the full impact of the global recession. In particular, we do not anticipate any significant commercial charters of NIWA's research vessels throughout the SCI period, and we expect international revenue to remain highly constrained while border restrictions remain in place.

Beyond 2020/21 we have taken a prudent approach to growth in commercial revenue, seeing a steady recovery from the 2021/22 onwards. We have not provided for any growth in research funding during the SCI period, other than that driven by the phasing of National Science Challenge programmes. We continue to pursue opportunities to secure increased research funding however, as without it NIWA's ability to conduct fundamental research aligned with the goals of the nation will continue to erode.

Operating expenditure

In 2020/21, operating expenses are budgeted at $150.5M, up from $146.6M forecast in 2019/20. This increase is due to the increase in NSC-related subcontractor costs discussed earlier. Underlying expenses are expected to reduce year on year, reflecting a tight control on operating spending in the light of the difficult economic

environment. Importantly, however, while we have not been able to make any provision for salary increases in the 2020/21 year, we are not planning for any retrenchment in overall staff numbers during the SCI period.

Beyond 2020/21 we plan on continuing tight control of operating expenses, with modest year-on-year increases as we make provision for a return to inflation-driven increases in staff costs.

Balance sheet management

NIWA's science is capital intensive and requires an on-going investment in scientific equipment if we are to deliver excellent science, secure revenue and be financially sustainable. In order to protect the Company's ability to deliver the science that the nation needs for the long-term, NIWA's plans must continue to make provision for these essential investments despite the uncertain economic situation.

Alongside the Company's underlying requirement to continue to renew its science equipment and infrastructure, NIWA plans to make significant strategic investments in renewing many of its properties and facilities. The forecast set out in this SCI contemplates a requirement to spend in the region of $175M on renovating or replacing the physical infrastructure and buildings at most of NIWA's sites, including its regional centres. The bulk of this relates to NIWA's Future Property Programme, the Single Stage Business Case for which received Ministerial support in late 2019. NIWA expects to fund this investment requirement from a combination of its existing resources, operating cash flows, and debt facilities.

Additionally, during the 2020/21 year, we intend to complete the replacement of the administration building at NIWA's Northland Marine Research Centre as well as progressing the replacement of our field office in Tekapo with a facility more suited to our growing requirements in that area.

Cash flow

NIWA expects its operating cash flow to remain strong, with EBITDAF margin between 17% and 20% during the SCI period and EBITDAF between $28M and $31M. Beyond the period reflected in this SCI, NIWA expects to require debt financing of about $90M to support its strategic capital investment needs, with this financing being repaid over six years. This financing requirement represents a preliminary estimate only at this point. It is expected to evolve as the certainty of estimates both of the costs of NIWA's strategic capital spending needs and of profitability in the SCI out-years and beyond increases over time.

Dividend

Based on the strategic capital investment needs identified above, no dividends are planned during the period of this SCI; however, the NIWA Board will continue to review this on an annual basis.

Return on equity

NIWA's budgeted return on equity in 2020/21 is 5.0%, down from a forecast 7.5% in the prior year. This metric is expected to recover to 5.9% by the end of the SCI period.

Risks

The financial projections reflected in this year's SCI are characterised by a significantly higher degree of uncertainty than in a typical year. The full impact of the global recession is not yet clear, including in respect of its impact on the ability of central and local government, as well as other customers and stakeholders, to fund the research and applied science services than NIWA offers.

We note that a key challenge facing NIWA in the coming several years is the assumption reflected in this SCI that the Strategic Funding (SSIF) that underpins the Company's research capability will remain close to current levels throughout the SCI period. This continues a lengthy period during which the real value of this funding has eroded. NIWA's longer term financial planning assumes that a material increase in this funding will occur in the 2023/24 year, on the basis that it is unsustainable for SSIF funding to erode indefinitely. If SIFF were not

increased, then reductions in science capability would be required to maintain NIWA's financial sustainability beyond the SCI period.

We further note that the financials reflected in this SCI assume an increase in funding for research conducted at sea on the RV *Tangaroa*, beginning in 2022/23. If this were not to occur, then the long-term viability of the financial model for the nation's only significant deep-water research vessel would be in question.

Overall, we consider NIWA's financial planning to be realistic, and are of the view that there is broadly equal downside risk and upside opportunity. We are confident that NIWA's plans remain robust in the near term to potential negative volatility and we will actively monitor and respond to any emerging risks.

Architect illustration of NIWA's proposed new offices in Wellington.

NIWA Group
Ratios and statistics

Statement of Corporate Intent ($M)	Forecast 19/20	SCI 20/21	SCI 21/22	SCI 22/23
Revenue	159.48	159.82	159.84	164.89
Revenue growth	-1.1%	0.2%	0.0%	3.2%
Operating results				
Operating expenses & depreciation	146.63	150.53	152.09	152.47
EBITDAF	34.14	31.35	27.81	31.48
EBIT & dividend received	12.85	9.29	7.76	12.42
Profit before income tax	12.87	9.49	8.03	11.03
Profit after tax	9.71	6.83	5.29	8.76
EBITDAF per FTE	0.050	0.046	0.041	0.046
Average total assets	181.52	191.27	193.85	228.85
Average equity (Shareholders' funds)	129.44	136.05	142.11	149.13
Adjusted average total assets*	154.28	164.03	166.61	201.61
Adjusted average equity*	106.58	113.18	119.24	126.27
Capital expenditure (incl. Capital committed)	14.15	25.73	45.86	99.32
Capital expenditure % to revenue	8.9%	16.1%	28.7%	60.2%
Liquidity				
Current ratio	141.8%	189.6%	125.4%	79.3%
Quick ratio (aka Acid test)	3.46	3.61	1.89	1.14
Profitability				
Adjusted return on equity*	9.1%	6.0%	4.4%	6.9%
Return on equity	7.5%	5.0%	3.7%	5.9%
Return on assets	7.1%	4.9%	4.0%	5.4%
EBITDAF margin (aka Operating profit margin)	21.4%	19.6%	17.4%	19.1%
Operational risk				
Profit volatility	12.5%	18.7%	13.5%	9.1%
Forecasting risk (non-adjusted ROE)	1.1%	1.9%		
Coverage				
Interest cover	21.8	15.5	15.2	7.60
Growth/Investment				
Capital renewal	69.9%	122.3%	241.2%	553.6%
Funds available for distribution ($M)	0.0	0.0	0.0	0.0
Financial strength				
Gearing	0.0%	0.0%	0.0%	26.7%
Equity ratio (aka Proprietorship)	71.3%	71.1%	73.3%	65.2%
Cash and short-term deposits	47.60	43.91	19.28	0.50
Financial debt	0.00	0.00	0.00	55.83

Key: Statement of Corporate Intent indicators.

Performance targets 2020/21

NIWA will measure its performance against the outcomes and operating principles in its Statement of Core Purpose using the following set of indicators.

Financial indicators

Measure	Calculation	Reporting frequency	Forecast 2019/20	Target 2020/21
Operating margin	Earnings Before Interest, Tax, Depreciation, Amortisation and Fair-value (EBITDAF)/Revenue	Annual	21.4%	19.6%
Profit per FTE	EBITDAF/FTEs	Annual	$50,000	$46,000
Quick ratio	Current assets less inventory less prepayments/Current liabilities less revenue received in advance	Quarterly	3.46	3.61
Interest coverage	EBITDAF/Interest paid	Quarterly	21.8	15.5
Profit volatility	Standard deviation of EBITDAF for past five years/Average EBITDAF for the past five years	Annual	12.5%	18.7%
Forecasting risk	Five-year average of return on equity less forecast return on equity	Annual	1.1%	1.9%
Adjusted return on equity	NPAT excluding fair value movements (net of tax)/Average of share capital plus retained earnings	Quarterly	9.1%	6.0%
Revenue growth	% change in revenue	Annual	(1.1)%	0.2%
Capital renewal	Capital expenditure/Depreciation expense plus amortisation expense	Quarterly	69.9%	122.3%

Organisational performance indicators

Measure	Calculation	Reporting frequency	Forecast 2019/20	Target 2020/21
End-user collaboration*	Revenue per FTE from commercial sources	Quarterly	$95,000	$78,000
Research collaboration*	Publications with collaborators	Quarterly	93%	85%
Technology & knowledge uptake*	Commercial reports per scientist FTE	Quarterly	1.3	1.0
Science quality*	Impact of scientific publications	Annually	2.5	2.5
Operational efficiency*	Revenue per FTE	Quarterly	$233,000	$233,000
Operational delivery	% projects delivered on time	Annually	>90%	>90%
Strategic progress – operations	% Enabling Plan KPIs achieved	Annually	>90%	>90%
Strategic progress – science	% Science KPIs achieved	Annually	>90%	>90%

*Ministry of Business, Innovation & Employment generic indicators.

Science and support performance indicators

1. Regional climate change projections have been produced for New Zealand, the Southwest Pacific region and the Southern Ocean and used to inform mitigation policy and adaptation options.
2. Climate and hydrology seasonal forecasts and near real-time climate indices and data series have been produced and made available to stakeholders for operational decision making.
3. National greenhouse gas measurements and modelling have been used in the Integrated Global Greenhouse Gas Information System to support New Zealand inventory development, mitigation and verification activities required for transitioning to a low carbon economy.
4. Tailored information and guidance for whānau/hapū/iwi and Māori business on the management of natural hazards and climate change risks has been produced to support their resilience planning and decision making.
5. Coastal and river flood-plain climate change hazard and risk exposure has been quantified for use in regional and national risk assessments.
6. Spatial complexity in fish stocks and fisheries is better understood and has been incorporated into fish stock assessments.
7. The engagement of Māori communities in taonga species and customary fisheries research has enhanced their capabilities and informed local and regional decision making.
8. Completed assessment of the current status of selected fish stocks and projections of the impact of future yields, and assessment of the environmental impacts of selected fisheries on bycatch species and habitats, has informed Fisheries New Zealand management.
9. An objective assessment of the benefits, opportunities and limitations of water trading to aid water resource management in New Zealand has been completed and published.
10. A framework of setting 'bottom lines' and other management limits for suspended and deposited fine sediment in rivers has been incorporated into national freshwater policy.
11. Isotopic mapping across New Zealand rivers has been completed and is being used by and for regional councils to identify sources, pathways and fates of groundwater and runoff (and associated contaminants) discharging to streams and coastal zones.
12. Guidance on the cultivation and planting of native macrophytes for river, lake, wetland and estuary restoration has been developed and delivered to iwi partners who are undertaking restoration projects.
13. Design of a commercial scale, land-based recirculating aquaculture system for production of high value fish at the Northland Marine Research Centre has been completed and construction is underway.
14. The impact of environmental variability and change on annual aquaculture production levels of algae, shellfish and/or fish has been determined and informs industry pathways to adaptation or mitigation.
15. Marine biodiversity data from New Zealand and Antarctica have been curated and access provided to 5000–7000 new user-registrations.
16. New generation high-resolution satellite data have been used to map distributions of kelp beds over extended areas of the New Zealand coastline and the information made available to key environmental managers.
17. Models that predict risks to marine ecosystems from multiple stressors have been built for at least two New Zealand marine environments in consultation with Māori and end users.
18. A toolbox of data analytics has been developed and implemented, allowing NIWA staff to efficiently generate standard statistics for climate and hydrological data.
19. Data from NIWA's climate and hydrological networks have been collected to high quality standards, archived, audited, and made available to stakeholders.
20. NIWA's digital geospatial reference datasets (including river, coastal and marine classifications) have been maintained, updated and made available through NIWA's website.
21. RV *Tangaroa* has completed and met the science objectives of voyages to Antarctica, for fisheries stock assessments and the deployment of New Zealand's tsunami DART buoy network.
22. A replacement vessel for RV *Kaharoa* has been designed and costed to enable preparation of a business case.

23. The High Performance Computing Facility has met the computational demand from the New Zealand science community and the National e-Science Infrastructure for at least 98% of the time.
24. NIWA's Māori graduate programme has created opportunity for five Māori science graduates to advance into postgraduate and career pathways.
25. Research collaboration and training has been increased through the joint appointment of at least 10 NIWA staff through the Joint Graduate Schools with the Universities of Auckland and Waikato, and the Centre for Excellence with Otago University.
26. Knowledge transfer and stakeholder uptake has been enhanced through the publication of at least 100 media releases and science videos.
27. NIWA has sponsored at least 12 Science Fairs nationally to increase community appreciation of the role and benefits of science, especially for students of all ages.
28. The Detailed Design phase for the new Wellington and Hamilton buildings has been completed and Implementation Business Cases for both projects have been submitted to shareholding Ministers.
29. Leadership development and succession initiatives have been implemented to ensure we proactively grow current and future leaders.
30. A minimum of five targeted opportunities have been created to increase and further develop Māori research capacity to strengthen internal NIWA capability.
31. Inclusion and co-supervision of more than 80 postgraduates within our science programmes has increased science capability and capacity.
32. Additional health and safety staff training for our critical risk areas has been completed to enhance health and wellbeing.

Appendices

Statement of Core Purpose

NIWA's purpose is to enhance the economic value and sustainable management of New Zealand's aquatic resources and environments, to provide understanding of climate and the atmosphere and increase resilience to weather and climate hazards to improve safety and wellbeing of New Zealanders.

Outcomes

NIWA will fulfil its purpose through the provision of research and transfer of technology and knowledge in partnership with key stakeholders including industry, government and Māori to:

- increase economic growth through the sustainable management and use of aquatic resources
- grow renewable energy production through developing a greater understanding of renewable aquatic and atmospheric energy resources
- increase the resilience of New Zealand and South-West Pacific islands to tsunami and weather and climate hazards, including drought, floods and sea-level change
- enable New Zealand to adapt to the impacts and exploit the opportunities of climate variability and change and mitigate changes in atmospheric composition from greenhouse gases and air pollutants
- enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity
- increase understanding of the Antarctic and Southern Ocean climate, cryosphere, oceans and ecosystems and their longer-term impact on New Zealand.

Scope of operation

To achieve these outcomes, NIWA is the lead CRI in the following areas:

- aquatic resources and environments (with a focus on surface freshwaters and coastal environments)
- oceans
- freshwater and marine fisheries
- aquaculture
- climate and atmosphere
- climate and weather hazards
- aquatic and atmospheric-based energy resources
- aquatic biodiversity (including biosystematics) and biosecurity.

NIWA will work with other research providers and end users to contribute to the development of the following areas:

- biosecurity, freshwater and hazards management
- climate change adaptation and mitigation
- ocean floor exploration
- seafood sector
- urban environments
- Antarctica.

Operating Principles

NIWA will:

- operate in accordance with a Statement of Corporate Intent and business plan that describes how NIWA will deliver against this Statement of Core Purpose, and describes what the shareholders will receive for their investment
- meet its obligations as a Crown Company and remain financially viable, delivering an appropriate rate of return on equity

- develop strong, long-term partnerships with key stakeholders, including industry, government and Māori and work with them to set research priorities that are well linked to the needs and potential of its end users
- maintain a balance of research that provides for both the near-term requirements of its sectors and demonstrates vision for their longer-term benefit
- transfer technology and knowledge from domestic and international sources to key New Zealand stakeholders, including industry, government and Māori
- develop collaborative relationships with other CRIs, universities and other research institutions (within New Zealand and internationally) to form the best teams to deliver its core purpose
- provide advice on matters of its expertise to the Crown
- represent New Zealand's interests on behalf of the Crown through contribution to science diplomacy and international scientific issues and/or bodies as required
- seek advice from scientific and user advisory panels to help ensure the quality and relevance of its research
- establish policies, practices and culture that optimise talent recruitment and retention
- enable the innovation potential of Māori knowledge, resources and people
- maintain its databases, collections and infrastructure and manage the scientific and research data it generates in a sustainable manner, providing appropriate access and maximising the reusability of data sets
- seek shareholder consent for significant activity beyond its scope of operation.

Organisational Sustainability Charter

NIWA's goal is to provide the science to help New Zealanders manage the transition to a sustainable future, whilst aiming for least harm or lightest environmental footprint during our research activities.

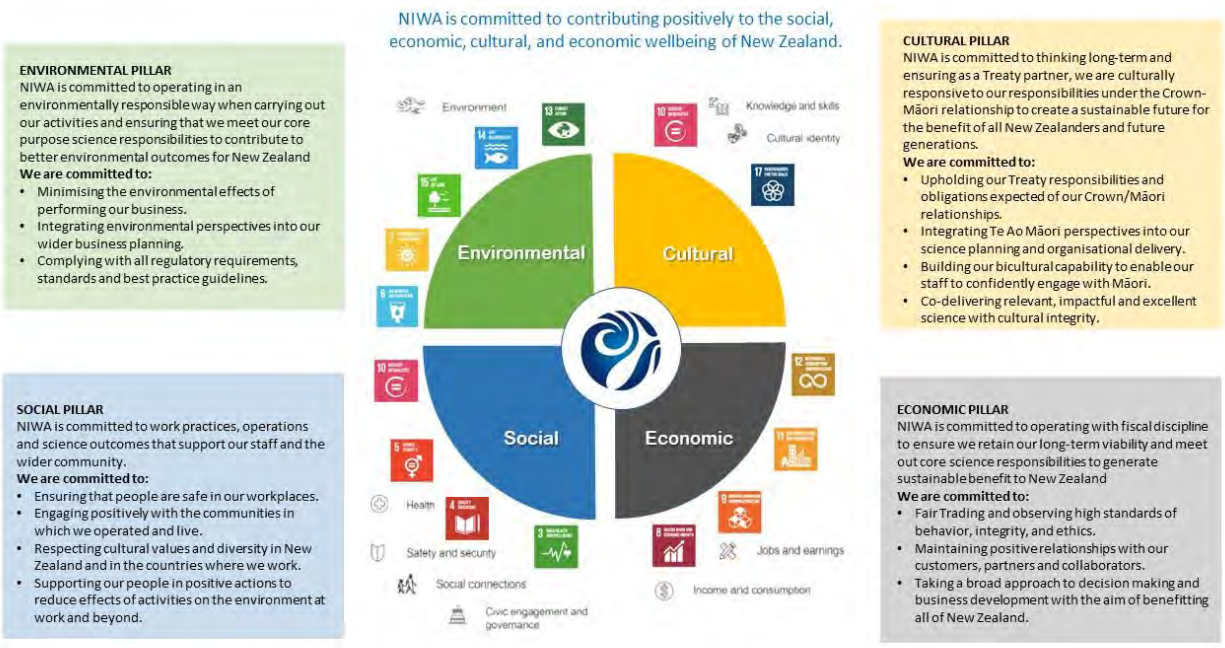
NIWA is committed to sustainability, working in innovative ways to deliver science and solutions, and helping our staff realise sustainability-focused approaches that impact, influence or contribute to societal change and environmental sustainability. We enhance the economic value and sustainable management of New Zealand's aquatic resources and environments and provide understanding of climate and the atmosphere and increase resilience to weather and climate hazards to improve safety and wellbeing of New Zealanders.

NIWA's Organisational Sustainability Charter embraces the United Nations Sustainable Development Goals and the New Zealand Treasury Living Standards Framework and sets out NIWA's broad intent and aspirations for both minimising its impact on the environment effects and contributing broadly to cultural, environmental, economic, and social sustainability. The Sustainability Charter is operationalised through a companion set of operating policies and principles which are used as a guide to our decision-making, including sustainability themes, actions, and SMART objectives that will help NIWA achieve its key business goals.

We will complete baseline assessments and continue to gather insights on the environmental, social, cultural, and economic issues and impacts of NIWA's activities. This will ensure we can respond appropriately to what matters to NIWA and New Zealand. Success will be measured by the effect of what we do, the application of our expertise, our community connections, and the economic and environmental health of New Zealand's resources.

We commit to Organisational Sustainability through:

- Investing in our people, technology and infrastructure;
- Providing advice and services to end users and stakeholders;
- Ensuring environmentally sustainable operations as practicable;
- Partnering with iwi, local communities and the wider society.



Other matters required by the CRI Act 1992

Information to be reported to Shareholders

NIWA will provide information that meets the requirements of the:

- Crown Research Institutes Act 1992 (the Act);
- Companies Act 1993;
- Financial Reporting Act 1993;
- Crown Entities Act 2004; and
- New Zealand Institute of Chartered Accountants (NZICA) with regards to Generally Accepted Accounting Practice (GAAP).

The following information is made available to enable our shareholders to make an informed assessment of NIWA's performance:

- A Statement of Corporate Intent (SCI) which sets out NIWA's strategy for delivering against its core purpose and the company's financial and non-financial performance targets. The draft SCI is due not later than 1 month before the start of the financial year (31 May).
- An Annual Report containing sufficient information to allow an informed assessment to be made against the performance targets in the SCI. This report includes comments on our core business and how we communicate our science, financial statements (including audit report), and a report from the Directors to the shareholders. The Annual Report is to be provided within three months of the financial year ended 30 June. A public Annual General Meeting is to be held no later than six months after balance date and not later than 15 months after the previous AGM.
- A Half-Yearly Report containing unaudited financial statements (including comparatives of the same period in the previous year) and major highlights during the period. The Half-Yearly Report is due within two months of the first half of each financial year ended 31 December.
- A Quarterly Report containing information such as unaudited financial statements (including current quarter and year-to-date budgets and a forecast for the financial year ended 30 June). The Quarterly Report also includes financial performance measures and progress towards meeting non-financial performance targets. The Quarterly Report is currently requested within one month of each financial quarter ended 30 September, 31 December, 31 March, and 30 June.
- Any other information relating to the affairs of the company, as reasonably required by shareholders, under section 20 of the Act and section 45B of the Public Finance Act 1989.

Policy and Procedure Statements

NIWA Group consists of:

- National Institute of Water and Atmospheric Research Ltd
- NIWA Vessel Management Ltd
- NIWA Environmental Research Institute
- NIWA Natural Solutions Ltd
- NIWA Australia Pty Ltd
- EcoConnect Ltd
- Unidata Pty Ltd

All companies have 100% ownership and voting interests, except Unidata Pty Ltd which has 80% ownership and voting interest. NIWA Group will adhere to the following procedures, as required to be discussed under section 16 of the Crown Research Institutes Act.

Accounting Policies

NIWA adopts generally accepted accounting practice in New Zealand as prescribed by the External Reporting Board. The accounting policies for the measurement and reporting of financial performance, movements in equity, financial position, and cash flows are detailed in NIWA's Annual Reports available at www.niwa.co.nz.

Dividend Policy

Profit retention and dividend distribution will be determined from year to year by the Board. The policy's objective is to ensure that an appropriate level of funds is maintained in the company to sustain financial viability, whilst providing an adequate return to the shareholders.

In considering this objective, the Board each year determines the level of surplus funds by reference to NIWA's:

- medium- and long-term capital investment requirements (including equity investments);
- ability to maintain and expand operational capability;
- ability to repay debt (if any);
- funding requirements for subsidiaries;
- capacity to fund RV *Tangaroa*;
- working capital requirements;
- legislative requirements, e.g., ensuring section 4 of the Companies Act 1993 (Solvency test) has been satisfied.

Any dividend would be paid within two months of the financial year-end.

Shareholder Consent for Significant Transactions

The Board will obtain prior written consent for any transaction or series of transactions involving full or partial acquisition, disposal, or modification of property (buildings, land, and capital equipment) and other assets with a value equivalent to or greater than $10 million or 20% of the company's total assets (prior to the transaction), whichever is the lesser.

The Board will obtain the prior written consent of Shareholding Ministers for any transaction or series of transactions with a value equivalent to or greater than $5.0 million or 30.0% of the company's total assets (prior to the transaction):

- the acquisition, disposal, or modification in a joint venture, partnership, or other similar association;
- the acquisition or disposal in full or in part of shares or interests in external companies, subsidiaries, and business units;
- transactions that affect the company's ownership of a subsidiary or a subsidiary's ownership of another equity;
- other transactions that fall outside the scope of the definition of the company's core business or may have a material effect on the company's science capabilities.

The Board will advise the Shareholding Ministers in writing (in the Quarterly Report) before entering into any transaction below this threshold related to property or to a specific commercialisation venture which involves change in intellectual property ownership or control.

Ratio of Shareholders' Funds to Total Assets

The target ratio of 'shareholders' funds to total assets' is as follows:

	2020 Forecast	2021 Plan	2022 Plan	2023 Plan
%	71.3	71.1	73.3	65.2

Shareholders' funds are defined as the sum of the 'share capital' and 'equity reserves' (otherwise called 'total equity').

Total assets are defined as the sum of the net book value of 'current' and 'non-current assets'. This is 'as disclosed' in the company's balance sheet as per the Annual Report, prepared in accordance with the accounting policies adopted by the Board.

Shareholders' funds and total assets are averaged over two years.

Commercial Value of the Shareholders' Investment

Section 16(3) of the Act requires the NIWA Group to furnish an estimate of the current commercial value of the Crown's investment.

The NIWA Board is satisfied that the net asset position (or shareholders' funds) as at 30 June 2019 is a fair and reasonable indication of the commercial value of the Group. The net asset position as shown in accordance with the company's accounting policies for 30 June 2019 was $126.257 million.

Activities where Shareholder Compensation would be required

The Board would look to seek compensation from the shareholders in the following circumstances:

- Where the shareholders instruct NIWA to undertake activities or assume obligations that would result in a reduction of the company's profit or net realisable value;
- Where the Board may consider undertaking strategic investments for the wider benefit of the New Zealand public, involving financial outlays beyond those incorporated within the company's Statement of Corporate Intent or financing capabilities.

No request for compensation is currently being sought from the shareholders. At this time no such investment has been identified, nor have any financial projections for such investment been included in NIWA's 2019/20 Statement of Corporate Intent. In the longer-term NIWA will be reviewing deepsea marine capability and future high performance computing capability and how investment in these national science infrastructure assets may be supported.

Other Matters Specifically Requested by the Shareholder

There are no other matters that have been specifically requested by the shareholders.

The following information can be found on NIWA's website:

- Personnel policy that complies with the principles of a good employer
- Equal Employment Opportunities programme
- Corporate Social Responsibility policy

Barry Harris, Chairman

Nick Main, Director

Directory

Board of Directors

Barry Harris (Chairman)
Nick Main (Deputy Chairman)
Dr Helen Anderson
Dr Tracey Batten
Professor Gillian Lewis
Mary-Anne Macleod

Executive Team

John Morgan (Chief Executive Officer)
Geoff Baird (General Manager Communications & Marketing)
Patrick Baker (Chief Financial Officer & Company Secretary)
Dr Barry Biggs (General Manager Technology & Innovation)
Dr Bryce Cooper (General Manager Strategy)
Dr Mary-Anne Dehar (General Manager People & Capability)
Dr Helen Neil (General Manager Operations)
Dr Rob Murdoch (General Manager Research)
Marino Tahi (General Manager Māori Strategy and Partnerships)

Solicitors

Bell Gully
Atkins Holm Majurey Ltd

Auditors

Price Waterhouse Coopers on behalf of the Auditor-General

Bankers

ANZ National Bank of NZ Ltd

Insurance Broker

Marsh Ltd

Registered Office

41 Market Place
Auckland Central 1010
New Zealand

Private Bag 99 940
Newmarket
Auckland 1149
New Zealand

Website

http://www.niwa.co.nz
https://www.facebook.com/nzniwa
https://twitter.com/niwa_nz

Back cover: Kingfish at NIWA's Northland Marine Research Centre. Onshore culture represents a significant opportunity to overcome issues associated with sea-based farming.
[Crispin Middleton]

Science working for New Zealand

The Crown Research Institutes (CRIs) proudly work, individually and collectively, to create a more prosperous, sustainable and innovative New Zealand

agresearch
āta mātai, mātai whetū

ESR
Science for Communities

GNS SCIENCE
TE PŪ AO

Manaaki Whenua
Landcare Research

NIWA
Taihoro Nukurangi

Plant & Food™ Research
Rangahau Ahumāra Kai

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50
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SCIENCE PROJECTS EACH YEAR

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J008885

NIWA
Taihoro Nukurangi

Climate, Freshwater & Ocean Science