Te oranga o te taiao o Tāmaki Makaurau

The health of Tāmaki Makaurau / Auckland's natural environment in 2020

A synthesis of Auckland Council's State of the Environment reporting

He mihi

Ko Ranginui e tū iho nei te matua e whakamarumaru nei i a tātou.

Ko Papatūānuku e takoto ake nei te whaea i ahu mai ai tātou te tangata, te papa e noho nei hei tūrangawaewae mō tātou katoa.

Ko Tāne e tū rangatira mai nei hei whakahaumaru i te tangata.

Ko Tangaroa hei whakaāio i te iwi.

Ko te hā o Tāwhirimātea hei hā ora ki te tangata.

Ka heke, ka heke, ki a tātou te tangata.

Haere te wā, haere te wā, ka tini te tangata, ka mahue i a tātou ngā hononga ki te rangi, ki te whenua, ki te ngahere, ki te moana.

Nō tātou te haepapa kia tiakina te taiao, hei whakamana i ngā whakareanga o mua, hei oranga anō mō ngā whakareanga ā muri nei.

Kia mārama tātou ki ngā pānga o te tangata ki ngā huringa taiao. Mā roto noa mai i te pūtaiao me te mātauranga e whakaorangia anō ai te mauri me te wairua o te taiao.

Kua eke te wā e tū ai te tangata hei kaitiaki i te whenua, i te ngahere, i te moana. Nō tātou katoa te haepapa – hoake!

Tuia ki te rangi

Tuia ki te whenua

Tuia ki te moana

Tuia te here tangata E rongo te pō, e rongo te ao

Tīhei mauri ora!

Ranginui, our sky father, provides our shelter from above.

Our earth mother, Papatūānuku, from whence all people originate, provides the foundations upon which we stand.

Tāne, god of the forests, stands as our protector.

Tangaroa, god of the seas, helps to calm us.

Tāwhirimātea, god of winds, provides the air we breathe.

We trace our descent from these gods.

Over time, we have multiplied, outgrowing our surroundings and forsaking our familial links to the sky, to the land, forests and seas.

We have a responsibility to care for our environment, to honour past generations and provide for those yet to come.

We must understand how we as people have changed our environment. Only through science and knowledge will we be able to restore its mauri and wairua.

Now is the time for us all to stand up as kaitiaki for our land, forests and seas. It is a responsibility we must all share – let us uphold it!

Bind the domain of the upper realm

Bind the domain of the land

Bind the domain of the seas

Bind the tapestry of life which affirms our connection to the natural world and to one another

Let there be life!

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Kupu takamua

Preface

Councillor Richard Hills

The natural environment in Tāmaki Makaurau is diverse and magnificent, from harbours, lakes and streams to productive soils, indigenous forest, maunga, ranges and motu. Our environment is a key reason people choose to live, work and play in our region.

With a land area of nearly 5000km^2 spanning from Te Hana in the north to Pukekohe in the south, Tāmaki Makaurau is home to a third of Aotearoa. To make the best decisions for the future, we need to understand where we are now and where we have been. Sustained long-term monitoring and reporting is critical. We need reliable data and science so that we can be informed and empowered to act to protect and restore our environment.

The breadth of work carried out in the latest state of the natural environment report is impressive. Thirteen technical reports underpin this synthesis which collectively provide the most comprehensive analysis of our natural environment. The report covers the state and changes over time in air, land, and water domains, to tell the story of the health of the natural environment in Tāmaki Makaurau. It also highlights key Auckland Council regional responses intended to improve the state of our environment.

Building on this report and its findings, we look forward to our continued work with mana whenua to integrate te ao Māori into our programmes and deepen and enhance our understanding and relationship with the world around us. Mana whenua exercise tino rangatiratanga and kaitiakitanga of their ancestral lands. I acknowledge and thank them for their partnership in restoring the mauri of te taiao (the environment), which benefits all communities in Tāmaki Makaurau.

The foresight of those who established our long-term monitoring has provided a depth of information to prepare us for future challenges. I would also like to acknowledge the work of the environmental specialists and scientists who undertake the monitoring and reporting all year round in all weather and terrain. I also thank the many communities and landowners taking action to protect and restore our region.

There are three regional pressures underpinning this report; How our urban areas grow and develop, how we manage our land and water, and the changing climate. Past decisions and the pressures of rapid population growth have had a negative impact on Tāmaki Makaurau and the current health of our natural environment reflects decades of degradation. This synthesis report does show some small improvements however, and this, along with the increased awareness and advocacy from our communities, provides hope for better outcomes in the future.

Through Tē Tāruke ā tāwhiri Auckland's Climate Plan we committed to a zero-emissions region that is resilient, healthy and better connected to the environment. Whether its partnership with mana whenua in the Kaipara Moana, collaboration with our pest-free volunteer groups, the significant investment through the water quality and natural environment targeted rates, or the unanimous support for Te Tāruke ā Tāwhiri Auckland's climate plan, there are signs we are moving the right direction.

We are aware of the scale of the challenge. It takes a commitment from all of us to restore our whenua, improve air quality, and clean up our beaches, rivers, and streams. We will continue this work with our mana whenua partners, communities, government and the private sector, so that future generations can inherit a Tāmaki Makaurau they can be proud of.

4000 PARKS INCLUDING **300KM** OF BEACHES

400 THREATENED SPECIES

36 DIFFERENT TERRESTRIAL AND WETLAND ECOSYSTEMS

48 MAUNGA WITHIN THE AUCKLAND VOLCANIC FIELD

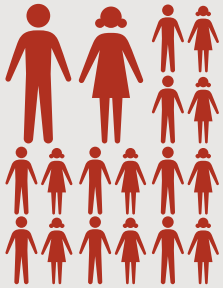
26% INDIGENOUS FOREST AND SHRUBLAND

46% EXOTIC GRASSLAND

TĀMAKI MAKAURAU
OUR REGION

1,717,500 PEOPLE

ONE-THIRD OF THE COUNTRY'S POPULATION



93.7% OF AUCKLANDER'S LIVE IN URBAN AREAS

11% URBAN AREA

4,941 SQ KM LAND AREA

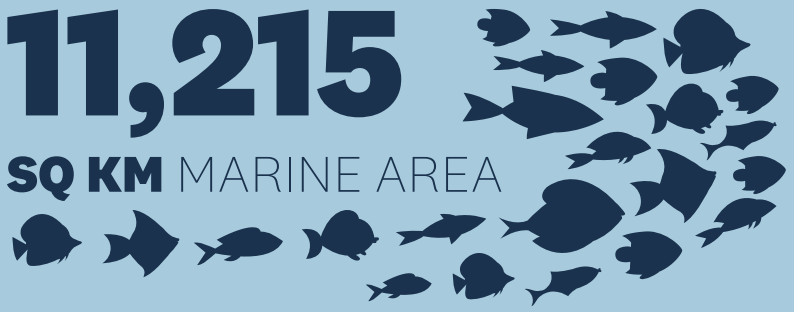
3,103 KM OF COASTLINE, SPLIT BETWEEN TWO COASTS

72 NATURAL AND ARTIFICIAL LAKES

19,000 KM OF PERMANENTLY FLOWING RIVERS ACROSS THE REGION

LESS THAN **1KM** BETWEEN THE MANUKAU AND WAITEMATĀ HARBOURS

11,215 SQ KM MARINE AREA



25 SPECIES OF SEABIRDS BREEDING IN THE REGION

Ngā karere mātua

Key findings

Hau
Air

- Overall air quality in Tāmaki Makaurau is good and improving.
- Exceedances of the National Environmental Standards for Air Quality (NESAQ) do occur sometimes.
- Key pollution sources are transport throughout the year and home heating in winter.
- Pollution levels have increased slightly in the city centre.
- Greenhouse gas emissions are dominated by the transport and energy sectors.
- Gross and net emissions in 2018 had increased from the 2016 levels due to increased emissions from energy, transport and industrial processes and product use (IPPU) sectors.
- Emissions have not increased as fast as population and economic growth.

Whenua
Land

- Indigenous land cover has increased (+ 656ha) across the region since 1996.
- Productive rural soils are over-fertilised and compacted.
- Several forest ecosystem types are severely depleted and many of our remaining forests are small and fragmented.
- Large forest areas support higher plant and ecosystem diversity and have fewer weeds, while smaller forests in rural and urban landscapes have more weeds and fewer native plant species.
- Tāmaki Makaurau forests are dominated by native plant species. Only 5 per cent of all plant species regionally are weeds.
- Most birds counted in forests (70 per cent) and wetlands (55 per cent) were native species.
- Our island sanctuaries and mainland managed sites are bird strongholds containing the highest ratios of native birds to introduced species.
- Problematic weeds and pests are only absent where intensive weed and pest control takes place.

Wai
Water

- There was a trend toward fewer river low flow days in summer and higher groundwater levels over the period 2010-2019.
- Groundwater quality showed minor improvements.
- Stream water quality improved at more sites than degraded. However, streams continue to be nutrient enriched, have declining visual clarity and generally high levels of *E. coli*.
- Streams with native forest catchments generally have the best ecological health, whilst urban streams have the worst.
- Health of monitored lakes continues to decline, with elevated nutrients and declining water quality particularly for nitrogen, water clarity and sediment.
- Coastal water quality is mostly improving but slowly.
- Ecological impacts from increased sedimentation have been detected in all harbours and estuaries.
- Levels of contaminants (copper, lead and zinc) in marine sediments are generally low. Hot spots of higher levels occur in muddy estuaries/tidal creeks with older intensively developed catchments.

Kupu whakataki

Introduction

The natural environment of Tāmaki Makaurau / Auckland is diverse. It is home to special local ecosystems and species in harbours, beaches, lakes, coastlines, maunga, rain-forest clad ranges, and the Hauraki Gulf motu/islands.

Our environment provides us with the air we breathe, fresh water we drink, locally produced food, and places to live, work and play. The health of the natural environment affects Aucklanders' health and wellbeing. Māori are connected to the natural environment through whakapapa and are kaitiaki. The spiritual and cultural connection Māori have to Tāmaki Makaurau is tied to their relationship with the land, maunga, harbours and waters. The health and wellbeing of the environment and people as part of that environment is paramount. Auckland Council has a stewardship role to protect and restore our natural environment, preserving it for current and future generations.

Our amazing natural environment may look okay on the surface, but its health is not always so great. Past decisions and the pressures of providing for a growing population, where we choose to live and how we use our land and water, have had a negative impact on the mauri (life force) of the natural environment across the region. A degraded environment is less resilient to cope with the impacts that climate change will have.

Providing for a growing population continues to add pressure to our degraded environment. This growth has been significant and rapid. Between the 2013 and 2018 Censuses, our population increased by 156,168 people, accounting for over a third of the overall national growth. The current population of 1,717,500 (as at June 2020) is projected to reach a population of 2.3 million by 2050. Current and future choices about where and how Tāmaki Makaurau grows influences how we address environmental degradation and the opportunities to use growth to restore our natural environment.

The Auckland Plan 2050 identifies three challenges facing Auckland now and into the future: environmental degradation, high population growth and sharing prosperity with all Aucklanders. The **Auckland Plan 2050 three-year progress report (2020)** outlined the mixed progress being made on reducing environmental degradation and the need to continue to address the challenge.

This report reinforces this need by building a regional picture of the health of the natural environment, how we are impacting it and where we are heading. This provides decision-makers with knowledge and evidence to help prioritise how we respond to the challenge of improving the health of the natural environment.

Purpose of this report

This synthesis report brings together results from technical reports, covering the state and changes over time in air, land and water domains, to tell the story of the health of our natural environment. It also highlights key Auckland Council regional responses intended to improve the state of our environment. Detailed analysis of data for indicators can be found in the supporting technical reports.

Why are we doing this?

Managing the region's natural resources is a core function of Auckland Council, set out in legislation. This includes monitoring and reporting on the state of all or part of the environment under section 35 of the Resource Management Act 1991. Monitoring can detect change in our natural environment and inform whether these changes are natural variations, related to climate change or an impact of other human activities. As a critical part of the 'plan-do-monitor-review' cycle, monitoring helps to identify what we should worry about the most, whether we are making progress (short- and long-term) or if there are new issues emerging as we resolve old issues.

All New Zealand regional councils monitor the natural environment. Data collected by Auckland Council feeds into national environmental reporting (managed by the Ministry for the Environment) to inform government priorities and to understand if Tāmaki Makaurau has similar issues to other regions. For more information on the issues for New Zealand see **Environment Aotearoa 2019**

State of the Environment reporting

This 2020 synthesis report is part of Auckland Council's State of the Environment (SOE) monitoring and reporting programme.

Data and information from SOE monitoring is reported in multiple ways. Raw data is provided on request and is progressively being made available via **our online data portal** and on the national **Land Air Water Aotearoa** (LAWA) website. **Technical reports** on individual programmes are also regularly published.

State of the environment monitoring and reporting generates knowledge to inform Auckland Council decisions on where to prioritise our response, actions and funding. It also enables us to measure progress and improve our understanding of the natural environment. SOE monitoring directly provides data, analysis and progress measures for:

- **Auckland Plan 2050 outcomes reporting**
- **Auckland Unitary Plan**
- **Te-Tāruke-ā-Tāwhiri: Auckland's Climate Plan**
- **Māori values reporting by the Independent Māori Statutory Board**
- **State of the Gulf reporting by the Hauraki Gulf Forum**
- **State of the Waitākere Ranges Heritage Area reporting**
- Auckland Council's implementation of national directives, such as the **National Policy Statement for Freshwater Management 2020**

In addition to this synthesis report, a series of case studies planned for 2021 will allow for more detailed assessment and evaluation of specific pressures, responses or trends that have been identified in the technical reports. A te ao Māori view of the wellbeing of the natural environment will be developed in 2021.

What did the previous State of the Environment report say?

The **2015 report** was the first State of the Environment report for Auckland Council providing a baseline for the challenges of a rapidly growing Tāmaki Makaurau. The report documented improvements to air quality but overall a declining health of land and water environments. Past decisions and development to provide for a growing population, changes to land use and how we use the land, as well as climate change were identified as adding to the pressure on the natural environment.

Additional information

The 2015 SOE report included indicators on climate and historic heritage. These topics have recently been reported on in a more comprehensive way and have not been included. The 2019 **Climate Change Risk Assessment** technical report series assessed impacts on people, the environment and infrastructure. These reports, and data from SOE monitoring programmes, informed development of **Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan**, adopted in 2020. While climate indicators are not reported as separate indicators here, climate change and the impacts on monitoring programmes are discussed throughout.

Since 2018, **Auckland's Heritage Counts** has reported annually to highlight key statistics and research on heritage places and buildings.

Detailed demographic information and trends from the New Zealand Census of Population and Dwellings can be found on the Auckland Census website, **Auckland Counts**.

Regular testing of faecal contamination at swimming beaches is carried out from November to April as part of the Safeswim programme. The programme combines monitoring and modelling to improve accuracy and timeliness of information provided to the public to make informed decisions about when and where to swim to reduce the risk of getting sick. Check **Safeswim** to swim safely at your favourite swimming spots.

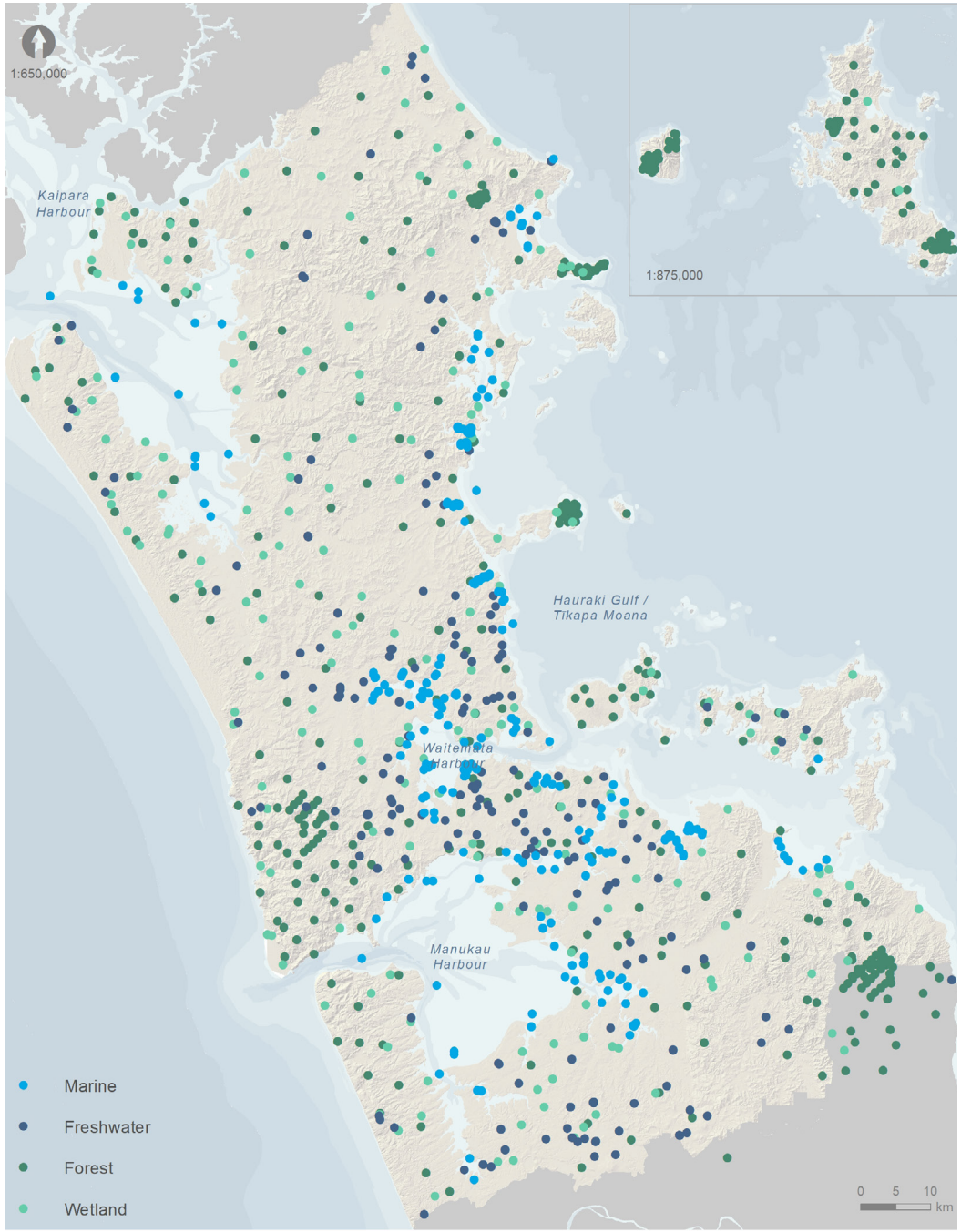
Tā mātou hōtaka aroturuki ā-rohe

Our regional monitoring programme

Monitoring is a systematic process that involves the planned and repeated collection of data, its analysis, interpretation, and reporting. It follows key principles:

- Regional coverage: To provide representative coverage across the entire Auckland region. Regional coverage also ensures a context and baseline to support the resource consent process and associated compliance monitoring.
- Representativeness: Sites are selected to be representative of a range of environmental conditions (e.g., native, rural, urban) or types (e.g., geology, soil type) within the region.
- Length of data record: Without consistent long-term data, short-term natural variability can mask chronic and/or cumulative impacts, often until critical levels are reached.
- Statistical design and analysis: The careful design of a monitoring programme is key to the analyses that can be carried out and the ability to make inferences from the data.

Monitoring is a core requirement to provide evidence to enable good decisions on how we respond to improve the state of the environment. Modelling is increasingly being used to inform our environmental decision-making, particularly to make predictions and test scenarios. Long-term monitoring is a vital source of data required to build models. Models also require ongoing validation, which means collecting more data to check predictions of the model.



Our monitoring programme covers the following areas:

Land and soil

The land monitoring programme measures the quantity and quality of the land and soil resource and the effects of land use. Soil quality has been monitored across the region since 1995 and 157 sites have been monitored.

Terrestrial biodiversity

Monitoring of forest/scrub/shrubland and freshwater wetlands began in 2009 and dune ecosystems were added in 2017. Approximately 400 forest plots, 250 freshwater wetland plots, and 23 dune systems are distributed across the region. Native, exotic and pest plant species are monitored along with bird diversity.

Freshwater quantity

Auckland Council's hydrological monitoring programme measures rainfall, river flow and groundwater level throughout the region.
The rainfall network consists of 78 rain gauges and 54 of these have collected rainfall data for more than 20 years, with the Albert Park site established in 1872. River flow is monitored at 40 sites, with some established as early as 1969. Groundwater level is recorded at 43 monitoring wells in seven major geology types. Most groundwater level records began between 1977 and 1997, providing a long-term record for the region.

Freshwater quality

River water quality is monitored monthly at 36 streams across the region using a range of physical, chemical and microbiological variables or attributes that can be affected by land use activities, point and diffuse source discharges, and land and instream erosion. Instream macroinvertebrates and habitat quality is monitored across 76 sites. Monitoring of lakes began in 1988 (there are some records for Lake Pupuke going back to 1966) with four lakes being monitored consistently through time. The lakes monitoring programme is currently being expanded to cover 16 lakes.

Marine

The health of our marine environments is monitored through three main programmes: monthly water quality (31 sites), sediment contamination (up to 120 sites) and ecology (110 sites - 33 in harbours and 77 in east coast estuaries). Monitoring of water quality and ecology began in the Manukau Harbour in 1987 and has since expanded to cover all the major harbours and most of the smaller estuaries on the east coast. Monitoring of sediment contaminants began in 1998.

Air

Key air pollutants are monitored at permanent monitoring sites distributed throughout the region. Some of our datasets date back to the 1960s, with consistent monitoring since the late 1990s. We also estimate emissions from various human activities to determine the major drivers of air pollution.

Greenhouse gas emissions

The Greenhouse gas inventory identifies and quantifies major sources of GHG emissions for the whole region and emissions have been estimated for 1990 and 2009-2018.

Hau

Air

Breathing clean air is critical to protecting our health. The fine particles and gases in air pollution can cause health problems such as asthma, bronchitis, heart attacks and cancer. Air pollution also reduces visibility, creating a brown haze sometimes. Air pollution comes from everyday activities including how we heat our homes, driving vehicles and carrying out industrial activities. Natural sources such as marine spray, bush fires and volcanic eruptions also contribute pollutants.

Despite Tāmaki Makaurau / Auckland's growing urban population, the long-term trends have seen improvements in air quality thanks to cleaner fuels, improved vehicle technology and declining use of solid fuels (coal and wood) for home heating.

While our geographic position provides a reliable airflow that helps to remove pollutants, we still experience air pollution in particular locations or at certain times of the year.

Air quality across Tāmaki Makaurau has been monitored consistently since the late 1990s. We use data from the monitoring network to assess compliance with the ambient concentrations of air pollutants with the **National Environmental Standards for Air Quality** (NESAQ) (set in 2004 and currently under review).

Te-Tāruke-ā-Tāwhiri: Auckland's Climate Plan sets the target of keeping within 1.5 degrees of warming and net zero emissions by 2050, with an interim emissions reduction target of 50 per cent by 2030 (against a 2016 baseline). An emissions inventory identifies and quantifies the most recent sources and sinks of greenhouse gas (GHG) and trends. This is an essential tool to evaluate our progress, frame mitigation actions and inform future policy development. The emissions inventory is prepared annually but is included with this state of the environment monitoring as air quality and greenhouse gases and their mitigations are so closely linked.

What we monitor		Why we monitor
Air	Particulate matter (PM) –PM_{10} and $PM_{2.5}$	Tiny particles (particulate matter) from polluting sources such as vehicles and smoke that get into the air. Breathing them may cause health problems.
	Nitrogen dioxide (NO_2)	Vehicles are the main source of NO_2 in Auckland. It can irritate the lungs, increasing susceptibility to asthma and lowering resistance to respiratory infections.
	Other pollutants	Air pollutants ozone, sulphur dioxide, carbon monoxide, black carbon and volatile organic compounds (VOCs) like benzene cause adverse health effects at elevated concentrations.
Greenhouse gas emissions	Carbon dioxide equivalent (CO_2e)	The climate is warming due to increased greenhouse gas (GHG) levels in the atmosphere caused by human activities. Reducing GHG emissions will limit temperature rise.

How healthy is our air?

E pai ana, e whakapaingia ake ana anō hoki te kounga o te nuinga o te hau ki Tāmaki Makaurau

Overall air quality in Auckland is good and improving

Auckland is not assessed as a polluted airshed under the national standards (NESAQ). The long-term trend for PM_{10} and NO_2 is decreasing. Shorter term trends show NO_2 concentrations at roadside sites plateauing or increasing, which coincides with increased traffic levels. Transport emissions continue to be the main source of air pollutants in Auckland, along with residential wood burning and industry.

Occasionally, exceptional events cause pollutant levels above the standard or target limits. In October 2019 the smoke from the New Zealand International Convention Centre building site fire led to the PM_{10} and $PM_{2.5}$ concentrations at the Queen Street monitoring site exceeding the NESAQ and the Auckland Ambient Air Quality Targets. The Australian dust storms and bushfires led to a PM_{10} exceedance detected at three sites (Papatoetoe, Penrose and Patumahoe) in December 2019.

E heke iho ana te kounga o te hau i te Tiriti o Queen

Air quality in Queen Street is declining

Data shows that since 2013 air quality in Queen Street has been declining with increases in $PM_{2.5}$ and PM_{10}, and NO_2. Annual NO_2 levels in Queen Street have exceeded the Auckland Ambient Air Quality Targets (as stated in the Auckland Unitary Plan) in 2017, 2018 and 2019. Full 2020 data is not yet available, but it is unlikely to exceed the annual targets due to reduced emissions during Covid-19 lockdowns. In 2020, diesel vehicle emissions led to six exceedances of the hourly NO_2 NESAQ in the city centre. Declining air quality is likely to be the result of diesel cars, diesel delivery vehicles, buses, construction vehicles and construction work at the lower end of Queen Street reducing ventilation.

E piki ake ana te tukunga o ngā haurehu kati mahana

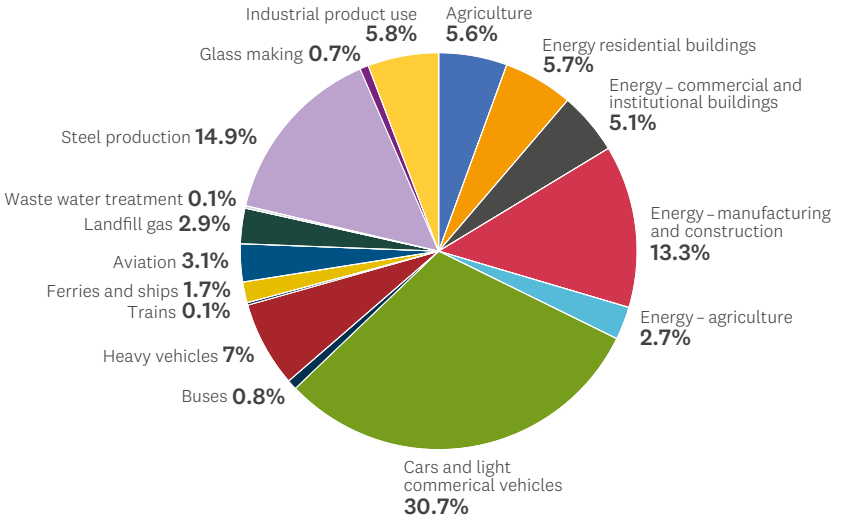
Greenhouse gas emissions are increasing

In 2018, Auckland gross emissions were 11,396 kilo-tonnes of carbon dioxide equivalent (kt CO_2e). When carbon sequestration from forestry is included, net emissions are 10,198 kt CO_2e. Transport and stationary energy are the dominant sectors, accounting for 43.4 per cent and 26.7 per cent of gross emissions, respectively. Carbon dioxide (CO_2) contributed 82.9 per cent, methane (CH4) 9.2 per cent, nitrous oxide (N_2O) 2.6 per cent and other GHGs 5.3 per cent.

Compared to 2016, the 2018 gross and net emissions have increased by 276 kt CO_2e (or 2.5 per cent for gross emissions, 2.8 per cent for net emissions). This is driven by increased emissions from energy, transport and industrial processes and product use (IPPU) sectors. The increasing trend has been occurring since 2009.

Increased carbon sequestration from forestry resulted in lower net emissions in 2018 than in 2009. In 2018, net emissions were 6.3 t CO_2e per capita and 93 t CO_2e per million $NZ GDP (2019/2020 prices) while gross emissions were 7.0 t CO_2e per capita and 104 t CO_2e per million $NZ GDP. These values were lower than in 2009 and show that emissions have not increased as fast as population and economic growth.

Auckland's greenhouse gas emissions profile (2018)



What we are doing

We will continue to monitor air quality to ensure Aucklanders continue to enjoy clean air across the region. Monitoring coverage of $PM_{2.5}$ will be increased in line with new NESAQ requirements.

To help us to achieve clean air we have set the Ambient Air Quality Targets within the Auckland Unitary Plan for a wider range of air pollutants and at differing exposure periods. These targets align with NESAQ and the guidelines set by Ministry for the Environment and the World Health Organization for the minimisation of health risks.

Making your home warmer, healthier and cheaper to run helps to reduce air pollution. Auckland Council provides advice to make your home healthy and energy efficient.

Reducing our greenhouse gas emissions is part of an ambitious work programme in Te-Tāruke-ā-Tāwhiri: Auckland's Climate Plan in 2020. We all need to work together to meet the target of keeping within 1.5 degrees of warming and net zero emissions by 2050 with an interim emissions reduction target of 50 per cent by 2030 (against a 2016 baseline).

To help meet this target and improve air quality as our urban areas continue to change and grow, Auckland Council has committed to green and healthy streets by signing the Fossil Fuel Free Streets Declaration (C40). The commitment will lead to procuring only zero-emission buses from 2025 and ensuring a major area of our city has zero emissions by 2030. Queen Street is prioritised to become a zero-carbon zone.

Initiatives to improve traffic and pedestrian flow in and around the city centre will improve air quality and reduce emissions, including:

- The refreshed City Centre Master Plan. It presents a 20-year vision for the city centre which is more family, pedestrian and environmentally friendly. This includes reducing general traffic movements and improving the public realm to be a sustainable and greener city centre.
- Completing the City Rail Link in 2024 which will double the number of people able to reach the city centre by rail in under 30 minutes. This will improve accessibility and transport choice across the region.

Refer to the following technical reports for further detail:

Air quality and societal impacts from predicted climate change in Auckland. TR2019/013.
https://knowledgeauckland.org.nz/publications/air-quality-and-societal-impacts-from-predicted-climate-change-in-auckland/

Auckland air emissions inventory 2016. TR2019/024.
https://knowledgeauckland.org.nz/publications/auckland-air-emissions-inventory-2016/

Auckland's greenhouse gas inventory to 2018. TR2020/026.
https://www.knowledgeauckland.org.nz/publications/auckland-s-greenhouse-gas-inventory-to-2018/

Trends in Auckland's air quality 2006-2018. TR2020/004.
https://knowledgeauckland.org.nz/publications/trends-in-auckland-s-air-quality-2006-2018/

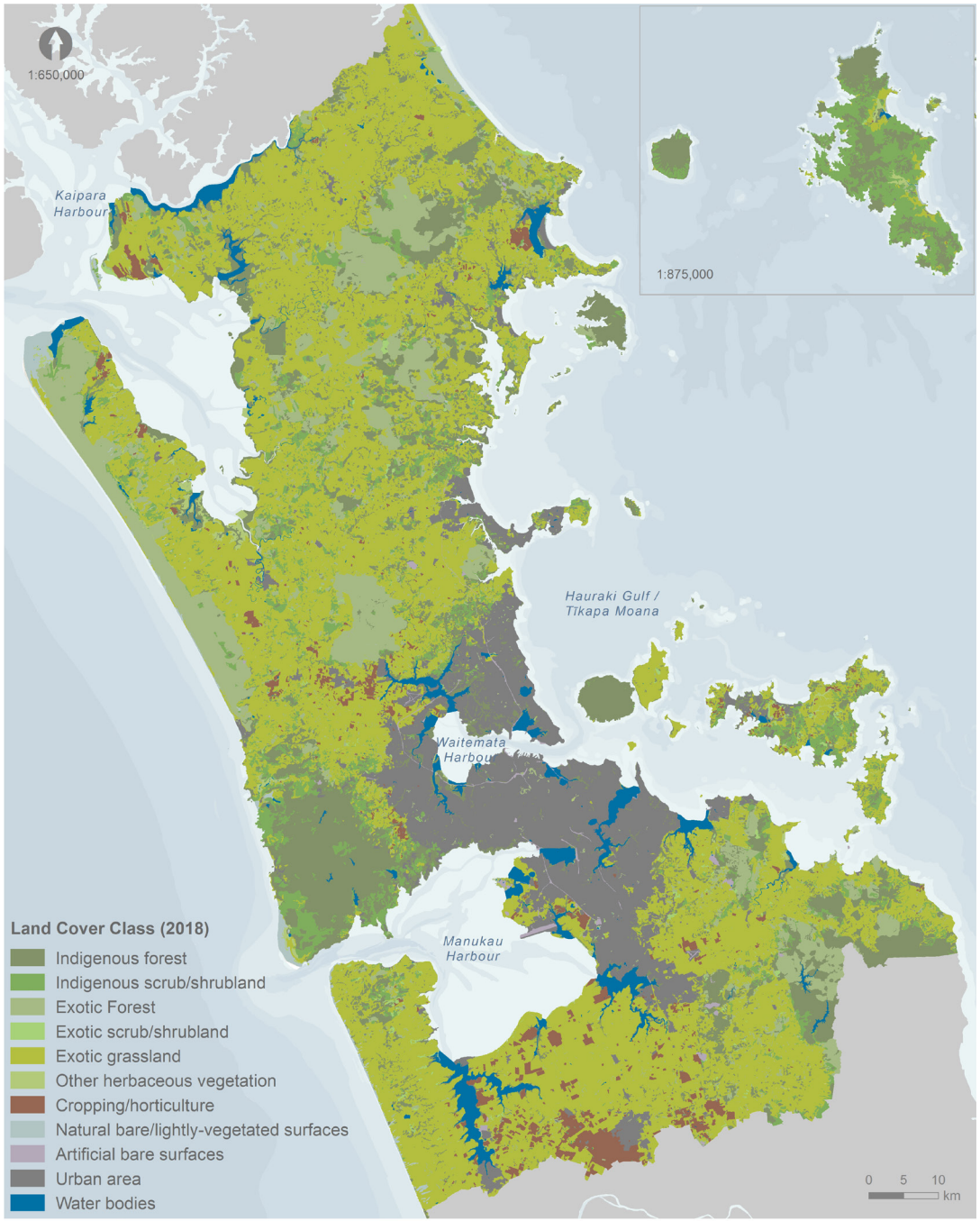
Whenua

Land

Tāmaki Makaurau / Auckland has a diverse range of ecosystems and landforms, extending across the mainland and the islands. This diversity supports a variety of native plants, animals and micro-organisms on land. Most of these are unique to New Zealand and some are found only in the region. These landforms, land cover, biodiversity and soils enable us to live, work and play using the land for growing food and timber, having clean water, and providing us with places to live and forests to explore.

The way we use land and how Tāmaki Makaurau grows places pressure on our biodiversity, landcover and soil resources. Native forest has been replaced over time with exotic grassland and urban development. This has resulted in loss of ecosystems and the diversity it supports. Many species are now threatened as their habitat has been degraded or removed. Pest plants, animals and pathogens also threaten survival of many species. Tāmaki Makaurau is estimated to be home to over 400 threatened species. Our changing climate will make it even harder for some species to survive.

Rural production continues to be a valuable and important part of the region and a functioning soil ecosystem is essential to support these land use activities.



What we monitor		Why we monitor
Land cover	Describes the types of vegetation and built or natural features that cover the land's surface	Land cover or how we use our land influences many of our environmental outcomes, e.g., extent of habitat for native species, land stability and the movement of water through the landscape.
Birds	Diversity and abundance of birds seen and heard in forest, scrub and shrubland, and wetland habitat	Birds are good indicators of ecosystem quality and health.
Pest animals	Pest animals – mice, rats and possums	Pest animals threaten native species and their ecosystems. We need to understand where they are and how their presence changes over time.
Native plants	Diversity, abundance and condition of native plants in forest, scrub and shrubland habitat	Provides a measure of the ecological integrity of a habitat plot.
Pest plants	Abundance of pest plant (weeds) species	Provides a measure of the dominance of pest plant species which can impact the quality and condition of native habitats. Weeds can out-compete native species and affect the provision of food for birds.
Soil	Soil quality – soil density, soil pH, organic carbon, total nitrogen, anaerobic mineralisable nitrogen, Olsen P, macro porosity	Healthy soil means nutritious food, effectively filters water, accommodates beneficial bugs and absorbs greenhouse gases. Poor soil quality can lead to increased nutrients and sediment entering our waterways.
	Soil trace elements – including arsenic, cadmium, chromium, copper, mercury, nickel, lead, zinc	Although trace elements are naturally occurring in soils, as a result of human activity higher concentrations accumulate over time and can have serious health and environmental effects.

How healthy is our land?

Landcover is an important determinant of the health of the environment across the region. Tāmaki Makaurau has a variety of landcover types, as shown on the map. According to the New Zealand Landcover Database version 5 (LCDBv5), about half of the land cover in the region is exotic grassland associated with sheep and beef or dairy farming. About a quarter of land cover is mature indigenous forest or indigenous scrub/shrubland regenerating towards mature forest. The remaining quarter is everything else including the urban area (11 per cent).

The greatest change has been the decrease in exotic grassland. However, it remains dominant in the landscape. Reductions in exotic grassland are largely the result of expansion of urban area (+7259ha) and exotic forest (+2242ha). The total area of indigenous vegetation (forest and scrub/shrubland) has been stable.

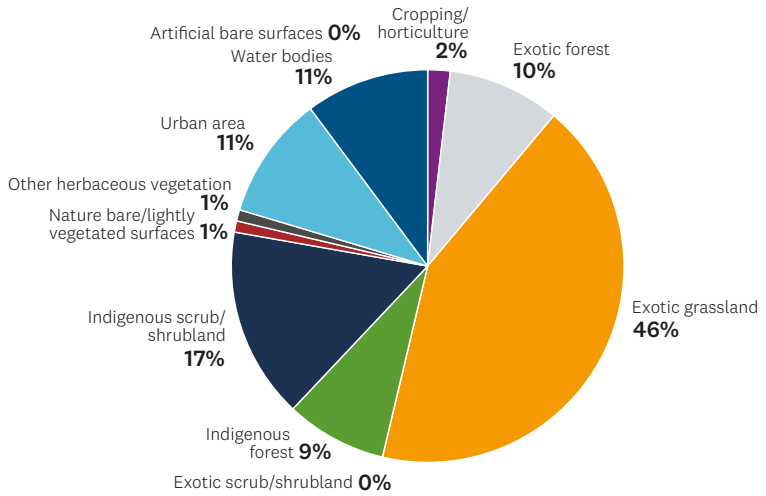
Exotic forest is trending downwards, despite fluctuations created by afforestation/deforestation cycles.

While there has been a net increase (+ 656ha) in indigenous land cover across the region, indigenous vegetation area gains (+1601ha) offset significant losses (-945ha). These losses are largely due to conversion to exotic forest and exotic grassland land covers and to a lesser extent urban area. Gains in indigenous vegetation on the other hand have come almost exclusively through conversion from exotic forest and exotic grassland and reflect regenerating areas as well as restoration and enhancement work by landowners, community groups and Auckland Council.

Land cover area change between 1996 and 2018 in hectares.

Land cover class	Losses	Gains	Net Change (%)
Artificial bare surfaces	-60	360	300 (21%)
Cropping/horticulture	-565	1,155	590 (5%)
Exotic forest	-3,141	5,383	2,242 (5%)
Exotic grassland	-14,173	2,905	-11,267 (-5%)
Exotic scrub/shrubland	-455	663	207 (10%)
Indigenous forest	-619	751	131 (0%)
Indigenous scrub/shrubland	-325	851	525 (1%)
Natural bare/lightly vegetated surfaces	-100	132	32 (1%)
Other herbaceous vegetation	-76	72	-5 (0%)
Urban area	-25	7,284	7,259 (15%)
Water bodies	-111	96	-15 (0%)

2018 Land cover (29 LCDB v5 classes found in Auckland are grouped into the 11 classes used by Land Air Water Aotearoa (LAWA).



Rural land continues to be subdivided into increasingly smaller land parcels. The number of property parcels within rural Tāmaki Makaurau increased by over 46 per cent (30,000) between 1998 and 2018. The greatest increase was in parcels 1-2ha (83 per cent), followed by parcels between 0-1ha (67 per cent) and 2-4ha (30 per cent). In 2018, over 90 per cent of parcels in rural Tāmaki Makaurau were less than 8ha with a seven per cent decline in the number of land parcels over 8ha. Subdividing into smaller land parcels makes it difficult for rural land uses such as pastoral farming that require large land parcels. Small land parcels can also restrict what areas are identified for urban expansion.

Kua nui rawa te whakawairākautia ngā one whaihua ki tuawhenua, kua pīhangaiti rawa hoki

Productive rural soils are over-fertilised and compacted

Healthy soil is important for growing food and forests. Soil stores carbon and manages water as it moves across the landscape. Applying too much fertiliser and using land intensively by over stocking or over cropping reduces soil health. This impacts water quality with leaching of contaminants and loss of nutrients from erosion or run-off. Compacted soils reduce plant growth. Monitoring soil quality provides a link between nutrient and contaminant source and land management practice. It is a useful tool for informing policies to improve land management and associated water quality.

Monitoring showed several soil quality indicators fell outside recommended guideline ranges. Olsen P concentrations (an indicator for plant available phosphorus) were high, particularly for horticulture and dairy sites.

Soil macro porosity (an indicator of soil compaction) was low, particularly for all pasture sites, and total carbon was low for outdoor vegetable production sites. These results indicate that phosphorus fertiliser is being applied in excess of what is required. Soil compaction reduces soil quality and productivity and increases surface run-off of nutrients and suspended sediments which can enter our waterways.

Trace elements occur naturally in soils and vary depending on the soil type, geology and climate. Different land use activities add trace elements to the soil. Mean concentrations of trace elements are all within guideline ranges. However, exceedances were recorded across individual monitored sites. Horticulture sites had the highest mean concentrations of cadmium and copper. Pasture sites had similar cadmium levels. Urban sites had the highest concentrations of arsenic, chromium, nickel, lead and zinc.

E whaioha tonu ana tā mātou whakapau kaha ki ngā manu me ngā tupu taketake

Our management efforts continue to work for native birds and plants

Remaining native forest in the Tāmaki Makaurau region supports an incredible diversity of bird and plant species and ecosystem types. However, forest landcover across the region is severely reduced compared to pre-human times, impacting many formerly dominant forest ecosystem types. For example, only 16 per cent of kauri-podocarp-broadleaf forest, two per cent of kahikatea-pukatea forest and 0.3 per cent of pūriri forest remains. Most remaining native forest and scrub still bears the imprint of historical logging and clearance but is showing signs of healthy forest regeneration.

Native forest areas in the Waitākere Ranges, Hunua Ranges and on Aotea/Great Barrier Island continue to be taonga for Tāmaki Makaurau. They have the highest levels of native plant species richness and ecosystem diversity, and lower incursion of weeds and introduced birds. These benefits result in large part from their size and lack of fragmentation.

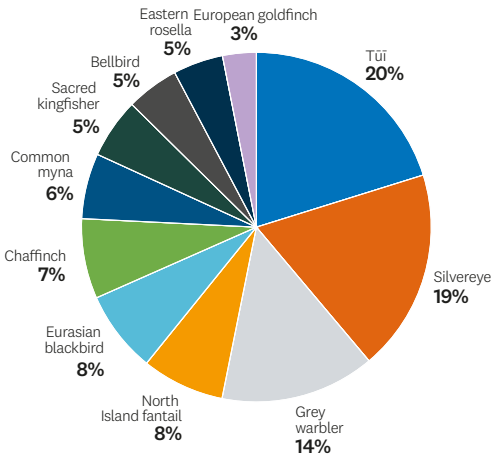
In contrast, most forest patches across the region are smaller and more fragmented. They support lower native species richness, fewer native and more introduced birds. Urban forests are notable for their weediness.

Native species make up most of the plants in Tāmaki Makaurau forests, with weeds composing only five per cent of all plant species regionally. However, forests with few or no weeds only occur where there is intensive weed control. Even large forest tracts are not insulated from weed incursions.

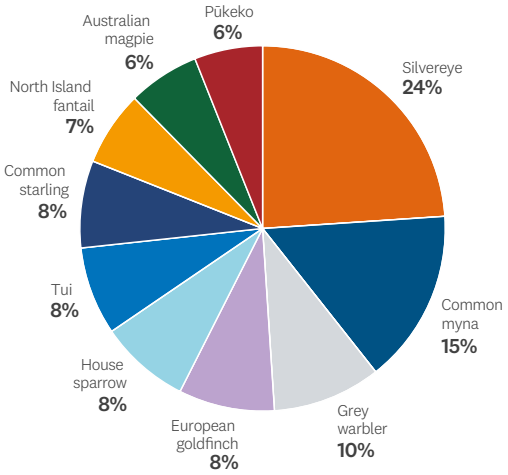
Most birds counted in forest (70 per cent) and wetlands (55 per cent) were native species. The highest percentages of native birds were found in protected or highly managed forest areas, both on offshore islands and in mainland sanctuaries. Te Hauturu-o-Toi/Little Barrier Island had the highest percentage where almost all birds counted were native. This was followed by Glenfern and Windy Hill on Aotea/Great Barrier Island, and the Kōkako Management Area in the Hunua Ranges, where on average 90 per cent of birds counted were native. These results show the high value of these sites as reserves for native birds. Sites in urban and rural areas had the lowest percentages.

For the first time we have analysed wetland birds across the region. Similar to the forest findings, there were higher ratios of native birds to introduced species in wetlands that are near or within our highly managed areas (regional parks/sanctuaries) and large forests such as in the Waitākere and Hunua ranges, and on Aotea/Great Barrier Island.

Top 10 forest birds



Top 10 wetland birds



What we are doing

Land management practices are important for healthy soil. The **Auckland Unitary Plan** protects elite and prime soils and encourages practices that maintain the capability of rural soils for producing food. Such practices include managing stock grazing areas during wet weather, reducing fertiliser use and reducing exposure of bare soil. Some of these practices are now being regulated through recent national directions on freshwater (**Essential Freshwater programme**) recognising the important connection between soil quality and freshwater quality. Future changes to the Auckland Unitary Plan to implement the **National Policy Statement for Freshwater Management 2020** will also contribute to reducing nutrient and soil loss.

Restoring habitats and protecting biodiversity requires effort and investment over the long-term. We will continue a focus on eradicating pests and weeds on the Hauraki Gulf islands and in mainland managed areas. These areas are biodiversity reserves and source populations for other restoration projects. However, weeds and pest animals are a widespread issue in all but the largest forest areas. Concerted council and community effort is required, along with investment in more areas outside of managed areas to provide biodiversity corridors and connections, including on private land.

The **natural environment targeted rate** is enabling increased investment in:

- Reducing the risk of spread of plant pathogens threatening native species, in particular kauri dieback.
- Increasing pest plant and pest animal control in and around public parks and in important habitats on private land.
- Improving data management and developing digital tools for connecting Aucklanders with conservation activities.
- Supporting community conservation, environmental innovation and Māori-led projects.
- Managing and reducing marine pests and pest plants and animals on islands to protect native species and ecosystems.
- Research into marine habitats and seabirds so we can better protect them.

Restoring vegetation in our growing urban areas provides habitat and movement corridors for birds in urban Tāmaki Makaurau. The **Auckland Urban Ngahere (Forest) Strategy 2019** has set a target of 30 per cent canopy cover across the urban area for both native and exotic vegetation. Mature trees help to capture greenhouse gas emissions, provide shade and reduce stormwater run-off.

At present we are actively managing 75 threatened plant and animal species. Island biosecurity ensures the ongoing protection of 39 bird, seven lizard and four plant species on predator free islands. Thirteen threatened plants are protected on council parks through intensive weed and pest animal control. Seven species that are extremely susceptible to possum browse, including the long-tailed bat, korimako/bellbird, kōkako, Hochstetter's frog and three epiphytic plants species, have been protected by pest control operation in the Hunua Ranges.

Auckland Council has implemented a region-wide Seabird and Shorebird Monitoring and Research Programme to help maintain Auckland as a seabird hotspot. Projects include establishing population and breeding success monitoring at key sites in the region, both on the mainland and the islands (e.g., Mokohinau Islands, Hauturu-o-Toi/Little Barrier Island, Noises Islands, Waitākere), spotted shag foraging ecology and restoration, and investigating threats to birds (e.g., pests, contaminants and pollutants).

A climate change risk assessment for terrestrial species and ecosystems was carried out as part of developing Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan. It is likely that climate change will exacerbate identified threats for many species and ecosystems. This includes physical disturbance and erosion, drought, fire and increased risk of damage from pests and diseases. Many ecosystems and species will need enhanced active management to survive these challenges.

Refer to the following technical reports for further detail:

Climate change risk assessment for terrestrial species and ecosystems in the Auckland region. TR2019/014.
https://knowledgeauckland.org.nz/publications/climate-change-risk-assessment-for-terrestrial-species-and-ecosystems-in-the-auckland-region/

Differences in soil quality and trace elements across land uses in Auckland and changes in soil parameters from 1995-2017. TR2020/001.
https://knowledgeauckland.org.nz/publications/differences-in-soil-quality-and-trace-elements-across-land-uses-in-auckland-and-changes-in-soil-parameters-from-1995-2017/

Diversity, abundance and distribution of birds in Tāmaki Makaurau / Auckland 2009-2019. State of the environment reporting. TR2021/08.
https://www.knowledgeauckland.org.nz/publications/diversity-abundance-and-distribution-of-birds-in-t%C4%81maki-makaurau-auckland-2009-2019/

Ecological integrity of forests in Tāmaki Makaurau / Auckland 2009-2019. State of the environment reporting. TR2021/01.
https://www.knowledgeauckland.org.nz/publications/ecological-integrity-of-forests-in-t%c4%81maki-makaurau-auckland-2009-2019/

Wai

Water

Aucklanders have strong connections to water across Tāmaki Makaurau. Water is highly valued, providing us with drinking water, food, recreation such as swimming, amazing views, and habitat for a diverse range of plants and animals. Our freshwater and marine environments hold immense significance for Māori. Water across the region takes many forms, including rainfall, aquifers (freshwater and geothermal), streams, rivers, lakes, wetlands, harbours and estuaries, and open coastlines.

Tāmaki Makaurau has nearly 19,000 kilometres of streams and rivers. Streams in volcanic geology receive a high proportion of their flow from groundwater, known as baseflow. Most of our streams are short and narrow, draining quickly to the coast. The topography in Tāmaki Makaurau forms rivers and streams that are typically slow flowing and low gradient, with predominately soft stream beds. Hard bottom streams are found in the Hunua and Waitākere ranges and on the Gulf Islands. These characteristics influence both the pressures on the quality and quantity of water in streams and rivers, and our responses to reducing the impact of these pressures.

There are approximately 72 lakes that are over one hectare in size across the region, (including constructed lakes). Most naturally formed lakes in the region are dune lakes, except for Lake Pupuke which is a deep volcanic lake. Most lakes in Tāmaki Makaurau / Auckland are connected to groundwater systems.

Tāmaki Makaurau has many aquifers which are a source of groundwater for irrigation, stock drinking, industrial use, municipal supply, and domestic uses. Tāmaki Makaurau also has two major geothermal aquifers in Waiwera and Parakai. Sandstones of the Waitematā Group are present in much of the region and form aquifers in many places. South Auckland has some of the region's most productive aquifers and prime soils, making this an important horticultural area.

Shallow volcanic aquifers in parts of the central isthmus are used for stormwater soakage (rather than being diverted to streams).

The coasts and harbours of Tāmaki Makaurau are one of its most highly valued natural features. The richly varied coast includes the open beaches of the west and east coasts, numerous sheltered bays and inlets, and four large harbours: Kaipara, Manukau, Waitematā and Mahurangi.

Although water exists in different forms in the region, it is a connected system flowing from the mountains to the sea (Ki uta ki tai). Our actions in one part of the system, such as on land, will affect other parts of the system, such as coastal water.

Over time, our freshwater and marine environments have been degraded from the pressures of our growing urban areas and how we use our land and freshwater. Cleaning up our rivers, lakes, streams and harbours is a priority for Tāmaki Makaurau.

What we monitor		Why we monitor
Rainfall	Rain gauge network	Rainfall is the fundamental part of the water cycle. Rainfall measurements inform water allocation, flood modelling, flood response, and the design of infrastructure, including stormwater networks and irrigation systems.
Rivers/Streams	River water quantity	River flow data informs the analysis of water quality state and trend, and the calculation of nutrient loads in rivers. Understanding river flow regimes aids in water management to ensure healthy ecosystems and ongoing water supply in summer months or under drought conditions.
	River water quality	Water quality parameters tell us about the natural functioning of our rivers and streams and help us to understand the impacts our activities have on them.
	River ecology	Ecology is a good indicator of overall stream health. Healthy streams have a diverse community of plants, invertebrates and fish.
Natural lakes	Lake water quality	Water quality parameters tell us about the natural functioning of our lakes and help us to understand the impacts our activities have on them.
	Lake plant ecology	Monitoring lake plant communities (native and invasive species) provides a good indicator of overall lake health.
Groundwater	Groundwater quantity	Groundwater level monitoring is key to understanding the underground movement of water; its relationship to rainfall infiltration, baseflow discharge to streams, and interactions between layered aquifers. This information helps determine sustainable limits for long-term water use.
	Groundwater quality	Activities on land affect the quality of water that infiltrates into aquifers. Groundwater quality data support management efforts for both water and land.
Coastal	Coastal water quality	Healthy coastal waters are important for recreation, fishing and marine organisms. Water quality parameters tell us about the natural functioning of our tidal creeks, harbours and open coast, and also help us to understand the impacts our activities have on them.
	Intertidal benthic ecology	Numbers and types of animals found in intertidal environments in our harbours and estuaries measure the health of these ecosystems.
	Contaminants in coastal sediment	Contaminants from the land enter rivers and streams and attach to fine sediments that settle and accumulate in sheltered coastal areas. The contaminants can be toxic to marine organisms living on and in the sediments.

How healthy is our water?

Waimāori – ngā ua, ngā wainuku, ngā awa/roma me ngā roto

Freshwater – rainfall, groundwater, rivers/streams and lakes

The **National Policy Statement for Freshwater Management 2020** (NPS-FM) sets out principles for the management of freshwater in New Zealand. The NPS-FM also sets out a National Objectives Framework (NOF) to identify values of our freshwater environments, to set objectives for those values, and a vision for the future, together with our communities and mana whenua. The NOF includes compulsory values, and attributes to measure those values. Bottom lines set minimum objectives. NOF attribute bands describe the current state of river and lake water quality and ecology where A is the best, and D or E is the worst.

E piki ake ana te kounga o ngā wai engari e noho whakaraerae tonu ana ki ngā pānga o te whakamahia o ngā wai i roto i te raumati

Water quantity was increasing but is susceptible to water use impacts over summer

A full understanding of the water cycle informs sustainable management of water resources so that we can balance the needs of the environment and the needs of Aucklanders.

Rainfall is the source of freshwater to all Tāmaki Makaurau environments. Rainfall data is a key input for sustainable water management. Rainfall varies each year but can be influenced by climate oscillations like the Interdecadal Pacific Oscillation (IPO) and the El Niño Southern Oscillation (ENSO). These two climate patterns did not have a clear impact on rainfall trends over the reporting period, but the data shows more rainfall (on average) in recent years.

Rainfall in the years 2010 and 2019 was low (<15th percentile), while rainfall for years 2011 and 2016-2018 was high (>75th percentile). Analysis has not captured the drought of 2020 as a full year of data was not available for the annual statistics required for this type of reporting.

The lowest river flows of each summer were compared over time. Many rivers had an increasing trend in summer low flows (i.e., more water in the streams during low flow periods) over the period 2010-2019 reflecting the increased rain in recent years.

Groundwater levels have increased in many parts of Tāmaki Makaurau over the last 10 years (2010-2019). This reflects the relative increase in rain over the same period. The biggest changes occurring in groundwater levels relate to either the stopping of water takes or large increases in water takes. This has led to both decreased water levels (Omaha Waitematā and Glenbrook Kaawa aquifers) and increased water levels (Waiwera geothermal and Parakai geothermal). Decreasing summer groundwater levels generally coincide with the summer irrigation season and are followed by full recovery over winter. The annual recovery of aquifer water levels suggests long-term sustainability, however, continued monitoring is important to confirm winter recharge and inform ongoing management of our groundwater resources.

Kua ririki noa te pikinga ake o te kounga o ngā wainuku

Minor improvements in groundwater quality

Shallow groundwater moves slowly through aquifers and eventually discharges to streams and rivers, lakes, or along the coast. Nutrients, bacteria and other contaminants from activities on land can be transported by water moving through soils and waterways into the groundwater system. Some nutrients, such as nitrate, can cause health issues when groundwater is used for drinking.

Elevated nitrate concentrations in some shallow south Auckland volcanic aquifers have been reported since the early 1990s, with data indicating increasing concentrations since the late 1960s. The aquifers are important water sources for horticulture, and fertiliser use in this area is a source of nitrate contamination.

Nitrates continue to be elevated in several shallow volcanic aquifers in the Franklin area. Many of these aquifers show improving trends in groundwater nitrate levels, however the rate of change is generally small, and slow to respond to changes in land management. Streams receive baseflow from these volcanic aquifers and nitrate in these streams falls below the NOF bottom line.

E piki ake ana te kounga o ngā wai i ngā awa me ngā roma i te nuinga o ngā roma, tē heke kē ai, engari inā tonu te nui o te mahi hei whakatutuki mā mātou

River and stream water quality is improving in more streams than degrading but there is still a lot more we need to do

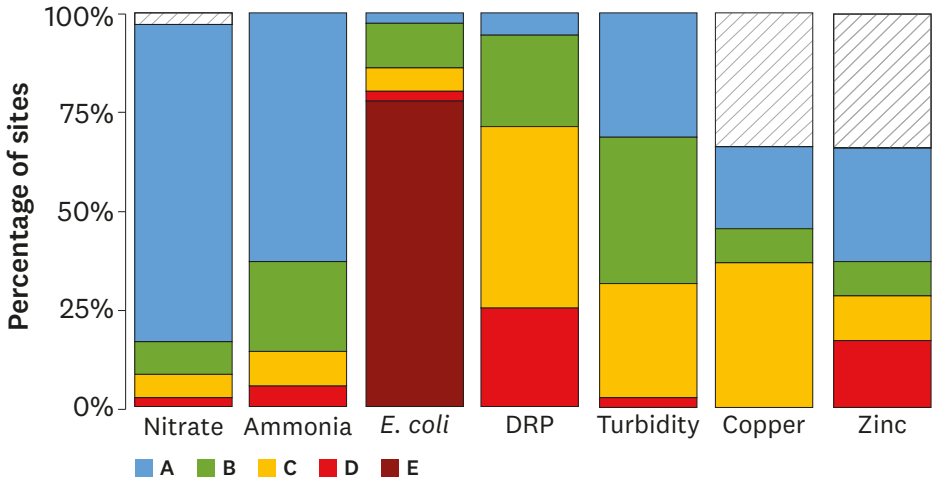
In many of our river systems, water quality at the top of the catchment is good where the land cover is predominantly native forest. Water quality declines as these river systems traverse productive rural areas and urban parts of their catchments. In many of our urban catchments the entire catchment may be urbanised – giving rise to the term ‘urban stream syndrome’, characterised by elevated temperatures, nutrients and contaminants, modified stream channels and reduced biological diversity.

Regionally our streams have instream nutrient enrichment and potential effects of eutrophication, declining visual clarity (based on turbidity), and generally high levels of *E. coli*. Nitrate and ammonia can be toxic to sensitive native fish and invertebrates. South Auckland rural streams are at risk of nitrate toxicity, and many urban streams are at risk of ammonia toxicity, with many of these streams continuing to degrade. Over a third of our monitored streams had low water clarity (based on turbidity) and these impacted streams had a higher proportion of degrading trends. While most rural and urban streams had very high levels of *E. coli* (NOF band E), over half were found to be improving in the last 10 years.

In addition to attributes included in the NOF, Auckland Council has developed attributes for metal contaminants reflecting the importance of this pressure in Auckland. Most monitored urban streams are contaminated with zinc at levels greater than the proposed bottom line (band D). However, for many of these streams the trend is one of very likely improvement. No monitored streams were below the proposed bottom line for copper, however many rural and urban streams had very likely degrading trends in relation to instream copper concentrations.

For most of the water quality indicators measured, more streams were improving than were degrading over the 10 years assessed (2010-2019). However, the rate of improvement was small and it may be years before we see improvements in the water quality of those rivers and streams that are currently in a degraded state. Of those that were degrading, the largest trends were generally associated with streams that have the poorest water quality (in the worst state).

Summary of the proportion of all river sites within each overall band across NPS-FM 2020 NOF and proposed Tāmaki Makaurau specific water quality attributes (2015-2019).



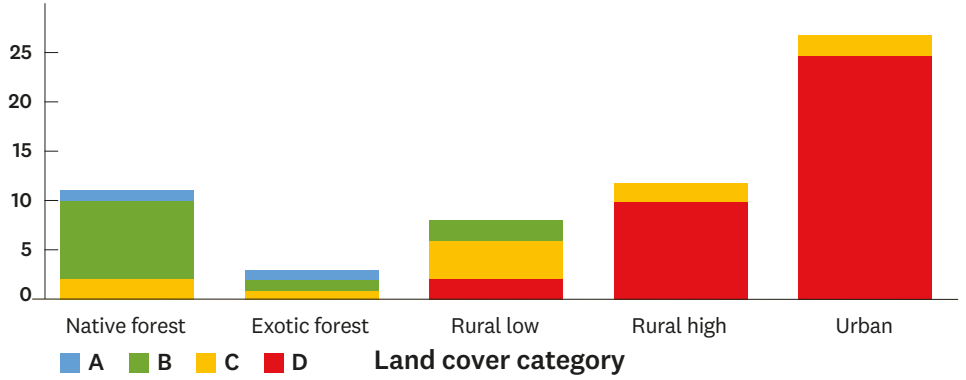
Kei runga noa atu te pai o ngā roma i ngā takiwā ngahere taketake, me te aha, ka whakaratohia e ērā ngā patanga hauropi pai rawa atu. Kei raro tonu ia e putu ana te hauora hauropi o ngā roma huri noa i te taone

Streams in native forest catchments generally provide the greatest ecological values. Urban stream sites have the worst ecological health.

Our rivers and streams host diverse communities of fish, aquatic plants, crustaceans (kōura), kākahi (freshwater mussels), and many invertebrates. Monitoring the health of everything that lives in a stream is not possible. We assess river health by monitoring the macroinvertebrate communities in rivers and streams across the Tāmaki Makaurau region. The types of macroinvertebrate communities present, their numbers and species diversity reflect the way we manage water quality, the flow of water through our streams and instream habitat.

Regionally streams within native forest catchments tend to provide the greatest ecological values. This is in terms of macroinvertebrate community composition and overall stream habitat and function. Although there were no obvious patterns in the spatial distribution of observed ecological state and trends, all measures showed a clear pattern of decline with increased land cover modification.

The number of sites in NPS-FM, MCI attribute bands by landcover type



Streams within the region are being adversely impacted by loss of vegetation and homogenisation of habitat as a result of channel modification and increased fine sediment loads. Urban sites were consistently found to be in the worst ecological health. These results are comparable to previous reporting and are consistent with national observations.

When assessed against the Macroinvertebrate Community Index (MCI) attribute in the National Objectives Framework of the NPS-FM, most of our sites (61 per cent) fall into attribute band D and are below the national bottom line for MCI. Most of these sites are located within the more modified rural and urban catchments. Assessed against the Auckland Unitary Plan interim guideline values for MCI, 40 per cent of sites are currently failing to meet guidelines, compared to 37 per cent for the period to 2014.

He tino kino te āhua o ō tātou tahuna me ō tātou roto puia

Our dune and volcanic lakes are in poor shape

Our lakes and their associated wetlands have rich aquatic communities. They contain black mudfish (which only occur in Northland, Tāmaki Makaurau and Waikato), native charophyte meadows (lake plants which are halfway between algae and land plants) and native and introduced fish species. Sediment and nutrient loads from surrounding catchments and invasive plant species can have major influences on lake ecology.

Every lake behaves in a slightly different way, requiring any management solutions to be lake specific. This includes understanding the impacts of land uses in the catchment, both past and present, as well as recreational uses of the lakes and the effects of a changing climate.

Lake Pupuke, Lake Wainamu, Lake Tomarata and Lake Rototoa have been consistently monitored over the last 10 years. An interim assessment against the NOF found all four lakes were above the national bottom lines for water quality attributes. However, many are still in poor ecological condition.

They have elevated nutrients and declining water quality, particularly for nitrogen, water clarity and sediment parameters. Three of the monitored lakes are in a 'eutrophic' state (meaning they have too many nutrients), with changes to aquatic vegetation, and/or are in a poor or non-vegetated ecological condition.

Of the four monitored lakes, Lake Rototoa has the best overall health (water quality and ecology). The lake is classified as mesotrophic (medium nutrient levels) with high ecological condition as defined by native aquatic plants present. The lake is vulnerable to land use changes which can impact nutrient levels.

Declining water quality in these lakes is a result of several long-term pressures, including land cover change, pest fish introductions, invasive plant introductions, historic changes in internal lake nutrient loading, and a changing climate.

NPS-FM 2020 NOF bands for lake water quality attributes (2015-2019).

	Total nitrogen	Total phosphorus	Ammonia (toxicity)	Chlorophyll a
Pupuke	B	A	A	C
Wainamu	B	C	A	C
Tomarata	C	B	A	C
Rototoa	B	A	B	B

Ngā tahatai, ngā Aka me ngā Wahapū

Coasts, harbours and estuaries

Today's estuaries have been shaped by the historic landform that was flooded by the sea and have been modified by sediment infilling (sourced from both the land and the sea). Estuaries are a mixing zone and interface that receive and transport nutrients and sediment daily from the land (via rivers and streams) and the sea. Most of our monitored estuaries and harbours are shallow, intertidally dominated environments.

Our open coasts are exposed to varying wind and wave environments which can lead to coastal erosion. At least 140 non-indigenous marine species have been recorded in the Auckland region. While not all become established here, others have become widespread.

E āta piki marie ake ana te kounga o ngā waitai

Coastal water quality is mostly improving but slowly

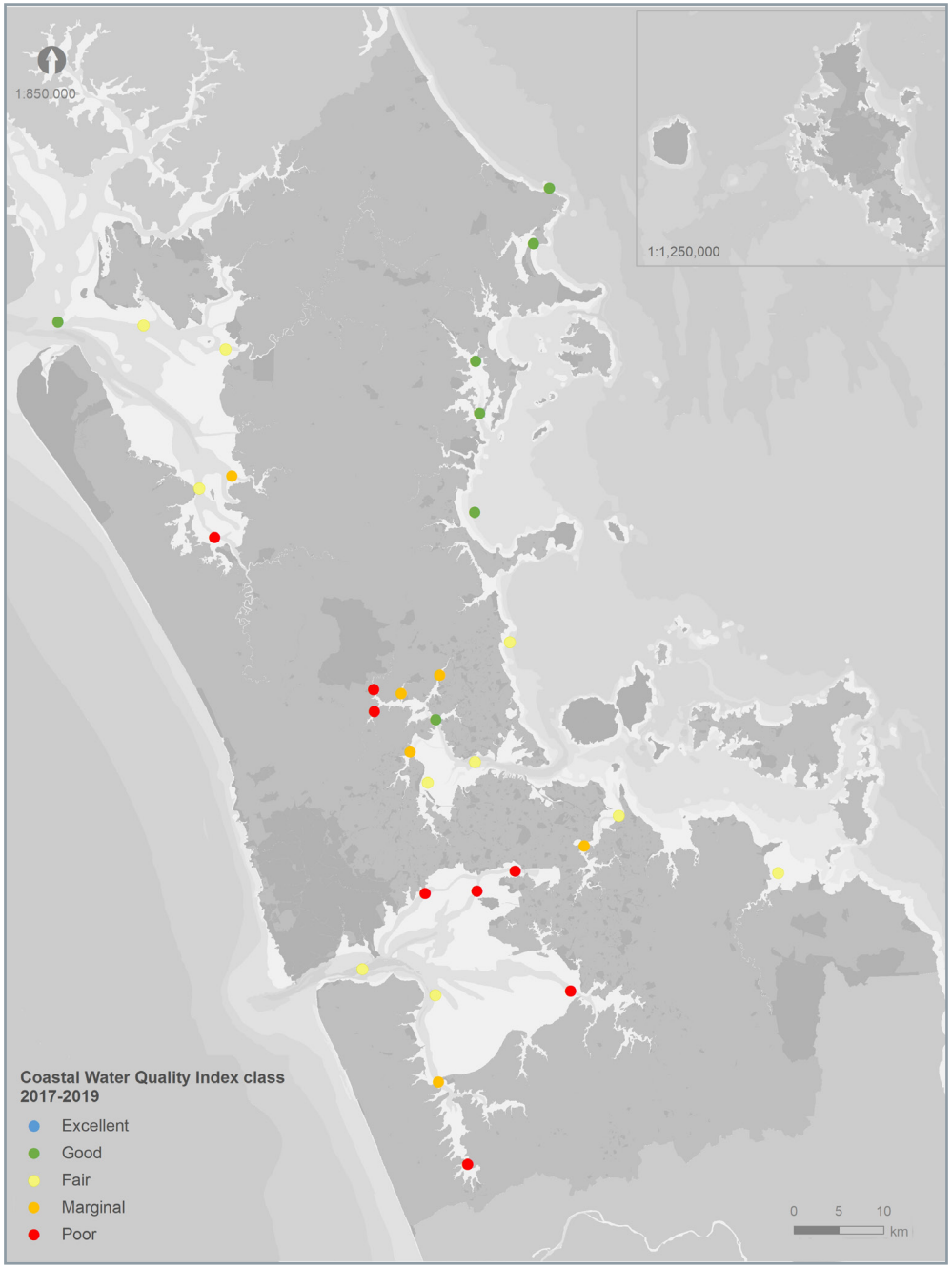
The state of coastal water quality has been assessed using our regional water quality index over 2017-2019. Water quality in open coastal sites and at harbour mouths is generally good, while upper estuarine (tidal creek) sites have poorer water quality. Overall, half of the monitored sites had good to fair water quality, and approximately a quarter of sites had poor water quality.

Elevated nutrient levels were the most common issue regionally. Water clarity was generally good and at most sites, only occasionally exceeded guideline values, particularly when monitoring coincided with higher river flows in the upstream catchments.

Regionally, areas with the highest concentrations of contaminants were mostly improving over the last 10 years. However, the rate of improvement is small and may take decades before we see an overall improvement in water quality.

Sites within the Manukau Harbour tended to have poor water quality due to elevated nutrients, higher levels of chlorophyll (algae), and lower water clarity. The greatest rates of improving trends in key nutrients were observed at sites within the Manukau Harbour however degrading trends in chlorophyll (higher levels of algae) and dissolved oxygen were observed, suggesting that the effects of eutrophication may be increasing.

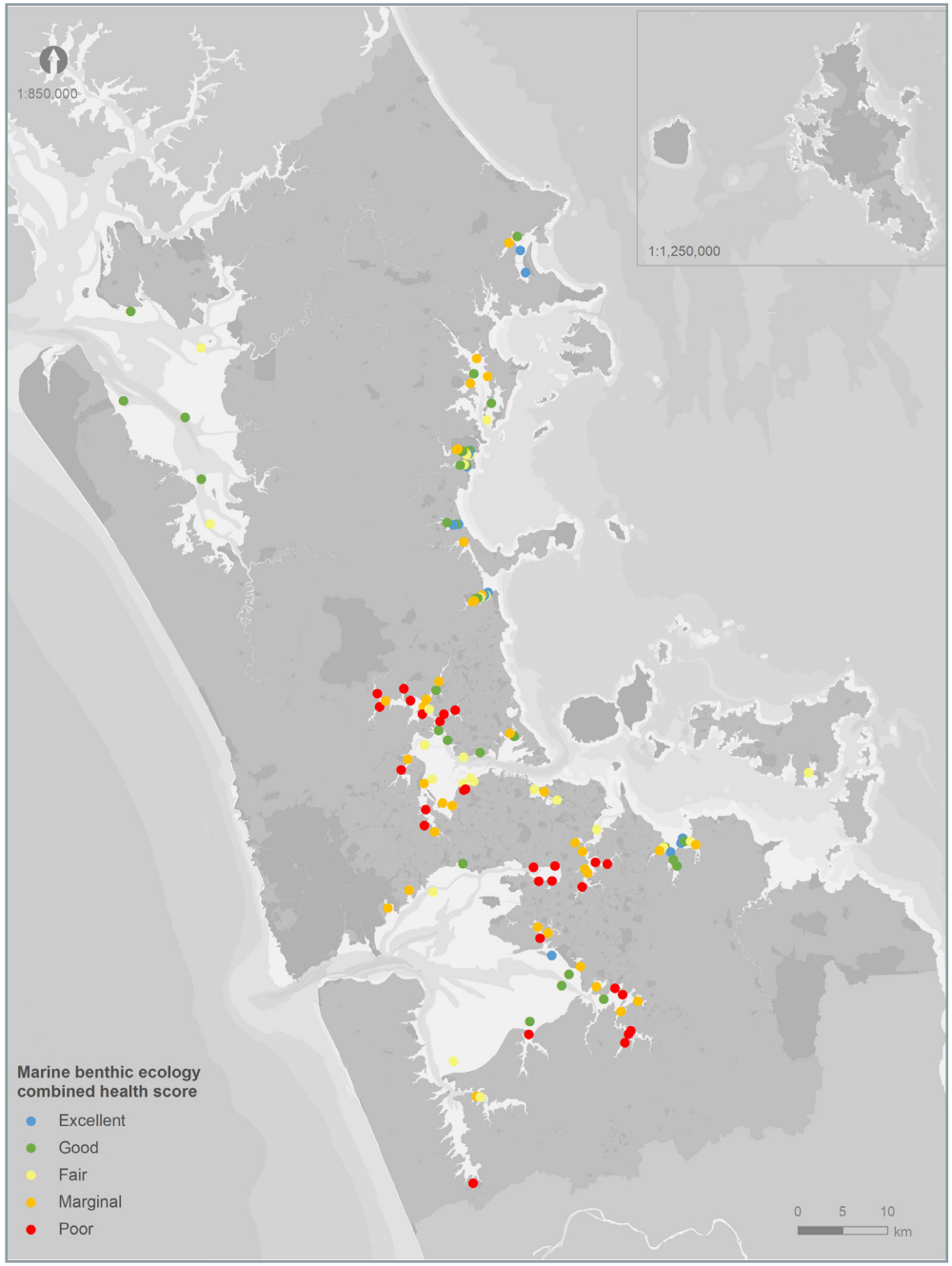
Most sites in the Waitematā Harbour had degrading trends in nutrients, suspended sediment and dissolved oxygen. The Tāmaki Estuary was generally improving, as was the Kaipara Harbour, particularly for turbidity.



E kauehu atu ana ngā aka me ngā wahapū, me te aha, e pāngia ana ngā koiora taihua

Harbours and estuaries are getting muddier, affecting intertidal life

Healthy intertidal sandflats support ecosystem functions that allow Aucklanders to obtain a range of ecosystem services from estuaries, including cultural



and recreational opportunities and food gathering. Coastal ecology monitoring focuses on surface sediment characteristics and macrofaunal assemblages (animals like starfish, clams, worms, etc.) to assess the ecological health of intertidal sandflats. Many of the species living in coastal and estuarine soft sediments around the region play important roles in the cycling of sediments and organic and inorganic contaminants, as well as being food sources for other animals like birds and fish. Monitoring occurs in the Kaipara, Waitematā, Manukau and Mahurangi harbours, and eight smaller estuaries.

Impacts from increased sedimentation have been detected in all estuaries. Although the Kaipara Harbour has predominantly 'good' health (according to a combined health score) multiple trends consistent with recent sedimentation were found at all sites except one. Likewise, all small east coast estuaries are affected by sedimentation with Okura, Mangemangeroa and Turanga exhibiting the greatest number of recent concerning trends (Whangateau, the northern-most estuary, has the fewest).

The tidal creeks of Manukau Harbour and the central Waitematā Harbour are very muddy, resulting in mostly low health. The open sandflats of these harbours tend to have lower sediment mud content and better health. There are no concerning trends related to sedimentation in the Manukau Harbour, but there are for some tidal creek and sandflat sites in the central Waitematā (around Meola Reef, Hobsonville, Whau River and Henderson Creek). There is no such distinction between the tidal creek and open sandflat sites in the upper Waitematā, with most having high mud content and 'marginal' health (three sites in the centre of the harbour are exceptions). In the last five years trends are emerging that indicate recent increased sedimentation at five sandflat sites throughout the upper Waitematā.

Nutrient enrichment may be affecting benthic health in some restricted areas, including the eastern side of Mahurangi, throughout upper Waitematā and in the western side of central Waitematā, but these patterns require further monitoring and investigation.

Heavy metal contamination is another region-wide pressure on estuarine benthic health, but is somewhat less prevalent regionally, than sedimentation. Trends related to metals in Kaipara and Mahurangi require further observation,

as they may reflect recent contamination. In Manukau and central Waitematā, health in relation to metals again tends to be lower in the tidal creeks (mostly 'fair' or 'marginal') than the sandflats (mostly 'excellent' to 'fair'). There is no distinction between these areas in the upper Waitematā (all sites are 'fair' or 'marginal'). Nevertheless, benthic health related to sediment-associated metals is improving in upper, central and outer Waitematā tidal creeks, suggesting historic rather than recent inputs.

He iti noa te tāhawahawa o ngā parataiao moana ki ngā konganuku taumaha, engari, ka puta tonu mai ngā pūwāhi wera ki ngā wahapū kauehu me ngā awa ruru kei tai

Marine sediments generally have low levels of heavy metal contamination, but hotspots occur in muddy estuaries and sheltered tidal creeks

Coastal sediments can accumulate chemical contaminants originating from land-based activities. These contaminants have the potential to build up, impacting the ecological health of an area by reducing the abundance or diversity of sensitive species. Monitoring the distribution of contaminants in marine sediments, their effects on aquatic ecology, and trends over time in chemical contamination, is important for management responses of coastal areas.

Tidal creek banks and intertidal sandflats retain sediment reflecting both past and present inputs of contaminants from urbanisation and industrial activities, and nutrients and sediments from rural activities. Most of the sites measured across the region still have relatively low levels of contaminants (copper, lead and zinc).

These are typically lower in less developed and rural areas and at sites with firmer, sandier sediment (i.e., East Coast Bays and outer harbour sites). There are several hot spots of higher contamination across the region. These tend to be muddy estuaries and sheltered tidal creeks in intensively urbanised or industrialised catchments (i.e., central Waitematā and Tāmaki Estuary).

What we are doing

There are some positive signs that water quality is improving in different parts of the region. These improvements are small and there is still more to do before we see improved water quality in more places at more times across Tāmaki Makaurau.

An important piece of work to increase gains in water quality region-wide is implementing the National Policy Statement for Freshwater Management 2020 (NPS-FM) for the Tamaki Makaurau / Auckland region. This will mean prioritising the health and wellbeing of water bodies with mana whenua and communities in catchments across the region to set objectives to better manage our freshwater rivers, lakes and groundwater. This will lead to changes to the current freshwater management approach in the Auckland Unitary Plan over the next few years.

Auckland Council continues to work to better understand the state of and pressures on our water resources through the development of new monitoring programmes, modelling and research collaboration with government agencies, mana whenua, other councils and research institutions. This includes:

- A new monitoring programme for periphyton (slime/algae) in streams to enable us to understand levels of nutrient enrichment that may cause excess algal growth. Periphyton does normally occur in healthy streams, but with too much nutrient it can grow excessively and remove oxygen needed by other aquatic life.
- Gaining more nuanced understanding of the relationship between land use, point source discharges, climate variability and management actions through the development of the council's Freshwater Management Tool.
- Expanding our monitoring of the region's lakes to include monthly monitoring of water quality in 16 lakes. This will provide a more detailed understanding of individual lakes across the region to inform current and future catchment management actions.
- Collaborating with the Lakes380 project to help understand historic land use changes in lake catchments and how this has impacted the health of our lakes.
- Understanding where our threatened fish species occur and protecting the habitat that they need to survive. We also work to improve fish passages in our rivers and streams to support the movements of our native freshwater diadromous fish as they migrate between freshwater and the ocean (for example, long and shortfin tuna/eels, and inanga).

- A new GIS model is being developed to estimate permitted water takes across the region (either from ground or surface water) to better understand how much water is allocated. These takes, allowed under Section 14 3(b) of the Resource Management Act 1991, allow use of water for human or stock drinking water without the need for a resource consent.
- Monitoring of rural catchment derived sediment yields from rainfall events will be reported early in 2021. This will improve our understanding of how sediment impacts coastal environments.
- Wetland monitoring results will be reported in 2021 and will inform our future monitoring and management approaches.
- Working in the Whau Estuary and catchment with research organisations, Te Kawerau ā Maki and EcoMatters, to identify the most important emerging contaminants and microplastics affecting our waterways, their source, and pathways for management and prevention. This research will inform the development of monitoring programmes for these contaminants.

Investment through the **natural environment targeted rate** and **water quality targeted rate** is focusing efforts on improving the health of the region's water resources. This includes pest fish eradication projects in lakes, marine biosecurity education and surveillance, catchment management planning, improvements to stormwater and wastewater infrastructure and support for community projects. Central government funding for projects such as the Kaipara Moana Remediation Programme, Mahurangi East Land Restoration and Hoteo Sediment Reduction Project are also contributing to improve the health of waterways and harbours in Tāmaki Makaurau.

Our regional stormwater network is now managed under a single, region-wide consent to discharge. This provides for integrated management of stormwater in Tāmaki Makaurau through clear processes and requirements. This will reduce the pressure of stormwater discharge from our changing and growing urban areas on water quality.

The Strategic Approach to Sediment programme has adopted a collaborative, cross-council approach to identify opportunities for improvement to reduce sediment runoff into our waterways and coastal waters. This has included more effective sediment controls at early stages on small development sites supported by proactive monitoring.

A climate change risk assessment for aquatic ecosystems was carried out as part of developing Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan. Aquatic ecosystems will be affected in many ways by a changing climate due to increasing sea levels, water temperatures, increasing extreme rainfall events with scouring, flooding, and additional sediment inputs, and decreasing pH. While climate change impacts alone are enough to change aquatic ecosystems, it is important to recognise that these climate-driven changes are occurring within systems already heavily affected by other human activities, as set out above. Ensuring the health and resilience of our aquatic ecosystems is a critical part of climate adaptation.

Refer to the following technical reports for further detail:

Climate change risk assessment for Auckland's marine and freshwater ecosystems.

Auckland Council technical report. TR2019/015

https://knowledgeauckland.org.nz/publications/climate-change-risk-assessment-for-auckland-s-marine-and-freshwater-ecosystems/

Coastal and estuarine water quality state and trends in Tāmaki Makaurau / Auckland 2010-2019. State of the environment reporting. TR2021/02

https://www.knowledgeauckland.org.nz/publications/coastal-and-estuarine-water-quality-state-and-trends-in-t%c4%81maki-makaurau-auckland-2010-2019/

Groundwater quality state and trends in Tāmaki Makaurau / Auckland 2010-2019. State of the environment reporting. TR2021/03

https://www.knowledgeauckland.org.nz/publications/groundwater-quality-state-and-trends-in-t%c4%81maki-makaurau-auckland-2010-2019/

Lake water quality state and trends in Tāmaki Makaurau / Auckland 2010-2019. State of the environment reporting. TR2021/04

https://www.knowledgeauckland.org.nz/publications/lake-water-quality-state-and-trends-in-t%c4%81maki-makaurau-auckland-2010-2019/

Marine ecology state and trends in Tāmaki Makaurau / Auckland to 2019. State of the environment reporting. TR2021/09
https://www.knowledgeauckland.org.nz/publications/marine-ecology-state-and-trends-in-t%c4%81maki-makaurau-auckland-to-2019/

Marine sediment contaminant state and trends in Tāmaki Makaurau / Auckland 2004-2019. State of the environment reporting. TR2021/10

https://www.knowledgeauckland.org.nz/publications/marine-sediment-contaminant-state-and-trends-in-t%c4%81maki-makaurau-auckland-2004-2019/

Rainfall, river flow, and groundwater level state and trends in Tāmaki Makaurau / Auckland 2010-2019. State of the environment reporting. TR2021/06
https://www.knowledgeauckland.org.nz/publications/rainfall-river-flow-and-groundwater-level-state-and-trends-in-t%c4%81maki-makaurau-auckland-2010-2019/

River ecology state and trends in Tāmaki Makaurau / Auckland 2010-2019. State of the environment reporting. TR2021/05

https://www.knowledgeauckland.org.nz/publications/river-ecology-state-and-trends-in-t%c4%81maki-makaurau-auckland-2010-2019/

River water quality state and trends in Tāmaki Makaurau / Auckland 2010-2019. State of the environment reporting. TR2021/07

https://www.knowledgeauckland.org.nz/publications/river-water-quality-state-and-trends-in-t%c4%81maki-makaurau-auckland-2010-2019/

Ngā wero me ngā āheinga

Challenges and opportunities

The 2020 synthesis report continues the story of previous State of the Environment reports – the health of many environmental domains in the Tāmaki Makaurau region remains degraded. There is some good news. Air quality is generally good. We are starting to see some minor improvements in water quality in some places. These improvements are mostly small, slow and are not occurring region-wide. There are improvements in native forest and birds where we put in substantial investment and management. This report has identified a range of responses we are taking to address these pressures. These responses are guided by strategic and statutory documents.

The Auckland Plan 2050 establishes the long-term strategic response to growth and development by setting out a quality compact urban form and identifying environmental degradation as a key challenge. The Auckland Unitary Plan manages allocation of natural resources and sustainable management of activities. It also identifies significant parts of the natural environment to be protected and enhanced as we use our land and freshwater.

Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan identifies the key priorities for delivery of climate action by stakeholders across the region. Delivering on these priorities will put Tāmaki Makaurau on a path to net zero emissions by 2050 and adapting to the impacts of climate change. Restoring our natural environment is a key part of meeting the goals of reducing emissions through carbon sequestration by forests, freshwater and coastal ecosystems and healthy soil. A restored natural environment will improve the regions resilience and ability to adapt to a changing climate.

Environmental impacts identified in this report can be summarised into three regional pressures.

How urban areas are changing and growing

Decisions on where and how Auckland grows and develops add to the intensity and severity of pressure on the existing degraded environment. Growth is also an opportunity to protect and enhance the natural environment.

How we manage our land and water

How we manage land and water use can impact the health of the natural environment. Impacts include releasing sediment and nutrients into waterways, removing native vegetation or compacting soil. Predators, pests and diseases are a major impact on our biodiversity that require ongoing management.

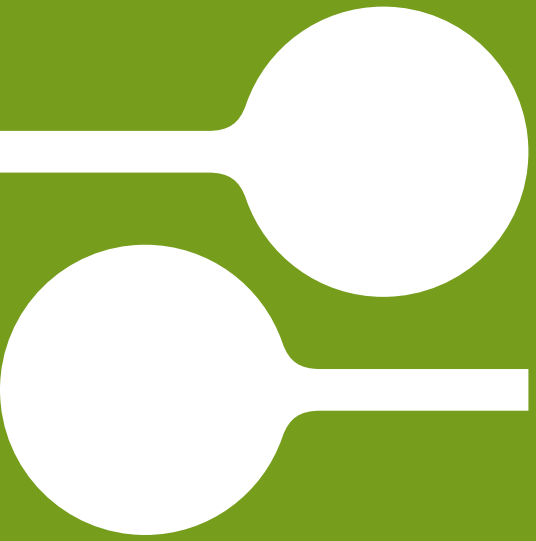
Our changing climate

Climate change will create new stresses and exacerbate existing stresses on our natural environment. Some impacts are already occurring. Other impacts are not yet known.

In 2018, Auckland Council committed to a natural environment targeted rate for council and community-led action to protect and restore priority native ecosystems and species, and to a water quality targeted rate for infrastructure and action to clean up our waterways. This has boosted our on-the-ground efforts to protect and improve our environment. Increased investment has provided the opportunity to think about things differently and engage communities to benefit our natural environment.

The degraded state of the environment highlighted by this report is not unique to Tāmaki Makaurau, with similar stories across New Zealand (see **Environment Aotearoa**). Addressing these challenges through the implementation of national directions in Tāmaki Makaurau over the next few years presents opportunities to reconsider how we can further improve the way we use our land and how Tāmaki Makaurau grows and changes. Our responses will be informed by evidence from monitoring and research. Working with mana whenua, recognising and aligning te ao Māori and mātauranga Māori will enrich our understanding of the natural world and changes through time.

The current state of our natural environment reflects decades of change, use and degradation. This 2020 synthesis report shows some small improvements, but there is still plenty of work to do to reduce degradation and build resilience in our environment. The challenges for our environment in Tāmaki Makaurau remain large, with continued population growth and the impacts of climate change. There are many tough choices that need to be made. However, there are also opportunities to work collaboratively, to do things differently, and to build on the progress achieved by many Aucklanders. Monitoring and reporting is a critical part of navigating these challenges and opportunities.



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