Manukau Harbour Environmental Assessment

Evidence base for ‘Achieving better environmental outcomes for the Manukau Harbour’ initiative

May 2025

aucklandcouncil.govt.nz

Manukau Harbour environmental assessment

Evidence base for ‘Achieving better environmental outcomes for the Manukau Harbour’ initiative

May 2025

Approved for Auckland Council publication by:
Name: Dave Allen Position: Manager Natural Environment Strategy Unit
Name: Louise Mason Position: General Manager Policy Department
Date: 12 May 2025

Recommended citation

Hart, G, A Bird, D Clelland (2025). Manukau Harbour environmental assessment. Evidence base for ‘Achieving better environmental outcomes for the Manukau Harbour’ initiative. Auckland Council Policy Department, Natural Environment Strategy Unit.

Cover image credit: Location: Āwhitu Peninsula Photograph by: Jay Farnworth

ISBN 978-1-991377-03-6 (PDF)

© 2025 Auckland Council, New Zealand

Auckland Council disclaims any liability whatsoever in connection with any action taken in reliance of this document for any error, deficiency, flaw, or omission contained in it.

This document is licensed for re-use under the Creative Commons Attribution 4.0 International licence.

In summary, you are free to copy, distribute and adapt the material, as long as you attribute it to Auckland Council and abide by the other licence terms.

Contents

Executive summary

Auckland Council is establishing strategic direction for its departments and council-controlled organisations to achieve better environmental outcomes for the Manukau Harbour, in recognition of the significant statutory role that the council has to ensure natural environment outcomes for harbours. This report is one in a series of supporting documents that identify the evidence base for the development of this strategic direction.

An assessment of drivers, pressures, state, impacts, and response in relation to the environmental health of the Manukau Harbour has been applied to identify:

- potential gaps in the council's environmental management for the harbour
- priority focus areas for setting SMART objectives to achieve five adopted environmental outcomes for the harbour.

Drivers and pressures

Auckland Council influences local scale drivers for the Manukau Harbour. For example, decisions related to environmental regulation, waste management, water services, land use zoning and transport infrastructure influence Manukau Harbour local scale drivers and pressures that can result in changes to the harbour's state. In particular, how growth and infrastructure are delivered, and their long-term impacts are highlighted as a key driver of pressures on the harbour's health.

The combination of catchment and harbour characteristics, its mix of rural and urban land uses, and proximity to the large population base of Tāmaki Makaurau / Auckland has resulted in a suite of land-based pressures altering the state of the harbour and causing a variety of environmental, social, and cultural impacts.

State and impacts

The state of the harbour today reflects both historic as well as current activities. Impacts from land-based pressures are most evident in the inlets and along the coast of the harbour, and less evident further away from land. However, some issues - such as pathogens and microplastics - may be more prevalent throughout the harbour.

The number of pressures and variety of causes and sources of pressures on the harbour mean that management response to improve the health of the harbour requires a suite of activities across the breadth of levers the council has available. In addition to the council, many other parties will undertake initiatives to respond to pressures on the harbour. This report addresses the council's activities.

Efforts to improve management of rural and urban activities have seen reductions in some contaminants. State of the environment monitoring is evidencing the resultant change in the state of the harbour. For example:

- water quality in the harbour is, overall, better than it was 30 years ago – in large part due to upgrades to the Māngere Wastewater Treatment Plant (even so, water quality is poor in the harbour's inlets)
- decreasing heavy metal contamination – indicating a reduction in heavy metal inputs to the harbour from improvements to the management of industrial activities and stormwater discharges, as well as the slow assimilation of legacy heavy metals into the environment.

Key messages on the environmental health of the Manukau Harbour

- Some marine and coastal habitats are in good health while others are not.
    - The mud and sandflats in the main body of the harbour are considered in good health - supporting a diversity of life and providing food sources for the many bird species that visit the harbour.
    - Historic loss of seagrass and saltmarsh habitat has not yet recovered.
    - Sedimentation has been building up on the seafloor in the harbour's inlets over a long period, which has reduced the diversity of benthic life in the inlets, which has numerous flow on impacts on life in the harbour.
- The Manukau Harbour is recognised as a nationally and internationally significant bird habitat because of the numbers and diversity of bird species; as well as the high numbers of endemic and threatened bird species present. Wading and seabirds face many pressures while in the harbour including habitat loss, pest animals, plastics, and disease.
- Commercially fished species' populations are believed to be relatively stable. However, limited information on finfish and shellfish populations in the harbour was identified. In relation to shellfish, monitoring of pipi and cockles at two locations reported low numbers.
- Most beaches around the Manukau Harbour are considered safe for swimming most of the time (24/29 beaches assessed).
- Organic contaminants, arsenic, mercury, copper and lead are not found in concerning levels in the harbour.
- Water quality is poor in the harbour's inlets due to elevated sediment and nutrient. Water quality is poorest in and around Māngere Inlet. Algal blooms that would be expected with the levels of nutrient observed are not regularly occurring, because of the light limiting impact of sediment in the water.
- Microplastics have been found at high levels in the sediments of Manukau Harbour beaches, compared to Kaipara and Waitematā harbour beaches.
- Climate change is affecting the harbour, including increased sea surface temperature, ocean acidification and rising sea levels. Climate impacts on marine species and habitats will increase over the century.
- Primary marine invasive species of concern are not found in the harbour; however, marine invasive species pose a future risk that requires ongoing focus.
- Toxoplasmosis from cats is present in the harbour and Tasman Sea and threatens Māui dolphins of which there are ~54 remaining.

Response – stocktake of Auckland Council environmental management activities

Auckland Council Group delivers on a broad suite of environmental management responsibilities and activities, some of which have delivered measurable improvements to the health of the Manukau Harbour.

Most of the council's activity is land-based. Marine and coastal activity is more limited.

More than 24 gaps – which can alternatively be framed as opportunities – were identified by reviewing environmental management activity in relation to identified pressure, state and impacts information. These will input into the identification of SMART objectives, which is the next stage of this initiative.

Priority focus areas for the setting of SMART objectives

The following priority focus areas for setting SMART objectives have been identified.

- Loss of terrestrial ecosystems, which has resulted in increased sediment generation across the catchment, reduced filtration of sediment and other contaminants before they reach the harbour, as well as the loss of or change to a suite of ecosystem functions and processes that supported life in the harbour.

- Loss of coastal and marine ecosystems, which has resulted in reduced habitat for species to shelter in and feed from as well as a suite of other ecosystem functions and processes.
- Sediment in the water column and sediment accumulation in and around the harbour's inlets, which has resulted in lower diversity of benthic species – reducing ecosystem resilience and food availability for fish and bird species.
- Nutrients in and around the harbour's inlets, which can reduce the life supporting capacity of the waters of the harbour; however, this impact is being limited in the harbour by the high levels of sediment observed at the same locations.
- A suite of pressures on wading birds and seabirds of the harbour – including pest plant and pest animals, people's recreational activities, pathogens (e.g. botulism), artificial lights at night, as well as sediment (noted above) smothering food sources.
- Toxoplasmosis, which is estimated to kill ~2 Māui dolphins annually along the west coast of the North Island. There are approximately 54 Māui dolphins.[1] They live exclusively along the west coast of the North Island in coastal waters adjacent to the Manukau Harbour; in the same area that toxoplasmosis concentrations are estimated to be highest in the marine environment, compared to the rest of the country.

Additionally, the following potential future pressures that are high risk:

- urban intensification and growth around the catchment
- climate change impacts on marine ecosystems, including increasing temperature, sea level rise and higher ocean acidity
- marine invasive species entering the harbour
- High Pathogenicity Avian Influenza reaching Aotearoa New Zealand and affecting birds of the harbour.

Supporting kaitiakitanga for the harbour by mana whenua, and people taking care of the harbour will also be priority focus areas for the setting of SMART objectives.

The findings of this assessment will underpin the setting of objectives in the next stage of this initiative, 'Stage 3' (see Section 1.2 Our Approach).

[1] Facts about Hector's and Māui dolphin.

Part 1: Introduction

1.1 About this document

Auckland Council is establishing strategic direction for its departments and council-controlled organisations to achieve better environmental outcomes for the Manukau Harbour coastal environment.[2] An ecosystem-based, integrated[3] catchment management framework is being applied to develop this strategic direction in four stages (see Figure 1).

This report is one in a series of supporting documents that identify the evidence base for development of this strategic direction. It summarises the analysis and findings of 'Stage 2' (see Figure 1) of this initiative, which aimed to identify priority focus areas for objective setting and management interventions by assessing:

- current state, pressures, and challenges in relation to the Manukau Harbour and specifically in relation to the environmental outcomes adopted in 'Stage 1'
- Auckland Council environmental management activity to address pressures on the harbour
- any gaps meaning that pressures aren't being addressed or outcomes are unlikely to be achieved.

To achieve the above aims an assessment of the drivers, pressures, state, impacts and Auckland Council response ('the assessment') was completed utilising existing, readily available information. The assessment findings underpinned gap analysis and identification of priorities for setting objectives. This report is set out in four parts:

- Part 1: Introduction
- Part 2: Manukau Harbour drivers, pressures, state and impacts
- Part 3: Auckland Council Group response
- Part 4: Gaps and priorities

The assessment has been completed to underpin Stage 3 of this initiative – which is to set SMART[4] objectives that will contribute to one or multiple outcomes sought for the harbour.

1.2 Our approach

To complete Stage 2 (see Figure 1) of this initiative a drivers, pressures, state, impacts, response (DPSIR) framework has been applied to assess information about the Manukau Harbour. DPSIR is a catchment-scale framework for analysing the relationships between society and the environment to inform management options and prioritisation.

DPSIR is useful for informing Auckland Council policy because of its focus on the connections between human activities and the environment. Each element of DPSIR has been defined as follows for the assessment.

[2] Auckland Council's Planning, Environment and Parks Committee adopted high-level strategic direction to achieve better environmental outcomes for the Manukau Harbour on 13 June 2024. The committee also endorsed the forward work programme for this initiative which included assessment of current state, pressures, and challenges for the environmental health of the Manukau Harbour; a stocktake of the council's current activity around the harbour and identification of gaps and priorities for improving the environmental health of the harbour and achieving the long-term vision and outcomes adopted in June 2024.

[3] In this context, integrated means integrated across the Auckland Council Group functions and activities.

[4] 'SMART' refers to: specific, measurable, achievable, relevant, timebound.

- **Drivers:** the social, demographic, and economic forces driving human activities that increase pressures on the environment (e.g. markets and population growth).
- **Pressures:** the stresses placed on the environment by human activities resulting from driving forces.
- **State:** the physical, chemical, and ecological condition of the environment and how these are changing.
- **Impacts:** the ecological, economic, social, and cultural consequences of changes in the state of the environment.
- **Response:** societal responses to mitigate negative impacts on the environment and halt or reverse environmental damage. In this assessment 'response' was focused on Auckland Council's activities that respond to pressures and impacts on the harbour.

The DPSIR framework has been applied in numerous contexts internationally, and in Aotearoa / New Zealand, for several decades; as well as being highlighted in good practice guidance for environmental monitoring and management in recent publications in Aotearoa.[5, 6]

DPSIR can be applied slightly differently depending on the context and project. As a result, numerous definitions for each element and additions to the framework have been developed and applied. One variation differentiates pressures from the activities that cause them through the explicit inclusion of 'activities' (A). Another adds human welfare (W) and measures of response (M) to make DAPSI(W)R(M).[7] These developments to the basic DPSIR framework have been considered in this assessment without adding explicit, additional elements to the framework.

The following sources have been considered to identify the drivers, pressures, state, and impacts across the harbour and harbour catchment:

- desktop review of Auckland Council technical reports, plans, and strategies across a broad range of topics, including state of the environment reports
- desktop review of wider published research and publicly available reports where appropriate
- workshops with relevant subject matter experts
- internal conversations with specialist technical staff, subject matter experts, and staff working on relevant projects and programmes
- modelling outputs (e.g. Auckland Council's Freshwater Management Tool).

New insights provided by 2025 state of environment reporting (due in late 2025) will be included in an update to this assessment as needed.

Auckland Council response

A stocktake of the council's current activity around the harbour and identification of gaps has been completed over the second half of 2024. The stocktake addresses the 'response' category of the assessment. This analysis builds on the stocktakes completed in 2020[8] and 2022[9] with a greater focus on

[5] Stevens et al 2024. Advice on indicators, thresholds, and bands for estuaries in Aotearoa New Zealand. Salt Ecology Report 141, prepared for the Ministry for the Environment.
[6] Sampath et al. 2022. Extending the DPSIR framework to analyse Driver-Pressure-State-Impact-Response of sand dune management in Manawatu-Whanganui (New Zealand) since the 19th century, Ocean & Coastal Management, Vol 230, 2022.
[7] Semeraro et al. 2024. DAPSI(W)R(M) put into practice for a nature-based solution: Framework applied to the Coastbusters approach, Nature-Based Solutions, Vol 6, 2024.
[8] infocouncil.aucklandcouncil.govt.nz/Open/2020/11/ECC_20201112_AGN_9849_AT.PDF (Item 9 Achieving better environmental outcomes for the Manukau Harbour).
[9] Report Plans of Environment and Climate Change Committee - Thursday, 8 September 2022 (Attachment 6 Achieving better outcomes for the Manukau Harbour).

identifying environmental management activities focused directly on, or significantly contributing to, improving the health of the harbour.

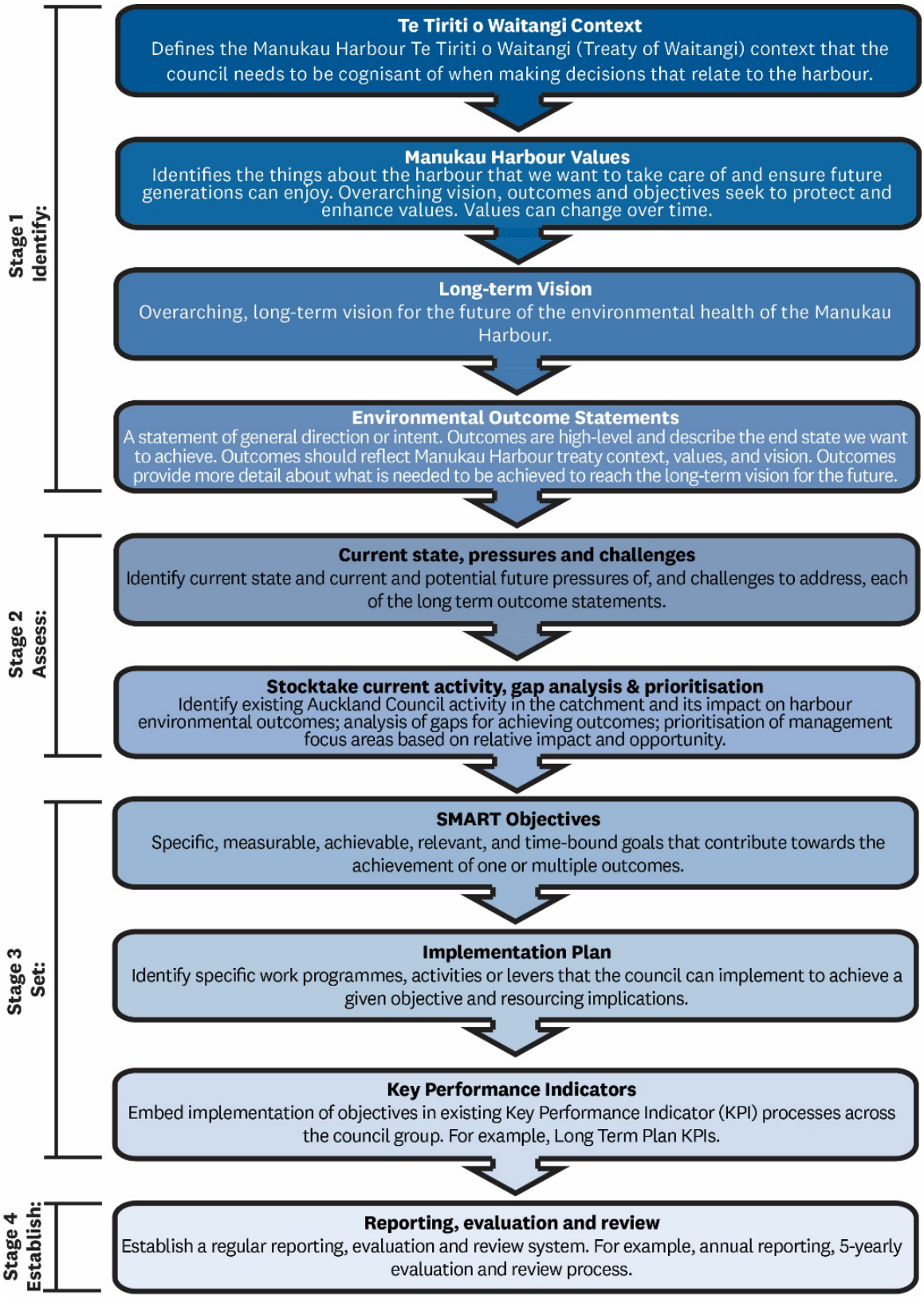

Figure 1. Steps to develop and implement integrated ecosystem-based coastal marine management approach for the Manukau Harbour.

The objectives of the stocktake are to:

- identify Auckland Council activities to address negative impacts on the environmental health of the Manukau Harbour
- assess the degree to which the council's activities are addressing identified pressures and impacts on the harbour and moving us towards the long-term vision and adopted outcomes for the health of the harbour[10]
- review council activities to identify any gaps that could mean identified pressures and impacts on the harbour are not being addressed.

Limitations

This assessment does not include mana whenua knowledge and stories related to drivers, pressures, state, impacts, and response. Mana whenua knowledge and stories are important to reaching an understanding of the harbour, as well as the information that was able to be identified for this assessment. A future goal is to expand this assessment to include mana whenua knowledge and stories related to the Manukau Harbour and its health.

The stocktake of Auckland Council activities is high level and is not exhaustive and is not likely to include every initiative, project or activity undertaken by the council. However, every attempt has been made to capture as much activity as possible to provide a balanced snapshot of the council's activities relating to the harbour environment. Information on the council's activities around the Manukau Harbour will continue to be collated so that any identified omissions in the stocktake can be addressed over time.

Gap analysis

Response activities were reviewed systematically against pressure, state, impacts information to identify – at a high level:

- where environmental management activity may not be fully addressing the pressure/s targeted
- where a known pressure may not yet have management activity in place
- knowledge gaps
- any gaps or opportunities to support kaitiakitanga and people taking care of the harbour
- other general, overarching gaps observed through this process of collating and assessing information about the council's activities and the health of the harbour.

Priority focus areas for the setting of SMART objectives

The assessment underpins the identification of priority focus areas for Stage 3 of this initiative, which is to set SMART objectives to achieve the five environmental outcomes outlined in the strategic direction for the Manukau Harbour.

All the information collated in this report was reviewed systematically to identify pressures and whether or not they are having a discernible impact on the health of the harbour (or area of the harbour). Impacts may be considered 'greatest' due to the scale of the issue, or because of the harbour values they threaten (for example, endangered species). Pressures identified to be having the greatest impact, or potentially greatest impact, have been included as a priority focus area. Pressures about which we have limited information to make an informed assessment are also included as priority focus areas, with the intent that

[10] Agenda of Planning, Environment and Parks Committee - Thursday, 13 June 2024 (Item 9)

these pressures remain a focus until enough information is available to inform the management response needed.

1.3 Manukau Harbour catchment

The characteristics of the catchment influence the activities and uses that people make of the area. As such, the harbour's characteristics can influence the degree to which people's activities add pressures to the environmental health of the harbour.

The terrestrial catchment of the Manukau Harbour is relatively small compared to the size of the harbour. It covers approximately 910 km^2, from the Waitākere Ranges in the north-west to Onehunga in the north-east, Mangere and Manukau in the east, Pukekohe in the south, and Āwhitu Peninsula in the south-west (Figure 2).

Much of the southern part of the catchment consists of lightly rolling terrain with well-draining fertile soils. Some of these fertile soils sit over a shallow unconfined groundwater table which provides the base flow for several streams. This creates an inherent vulnerability for groundwater to become contaminated from soluble contaminants carried through the soil profile with rainwater or irrigation. Interconnections between groundwater and the stream network can then result in contaminated groundwater entering streams and rivers connected to the harbour. The sloping terrain also makes the land inherently vulnerable to the loss of exposed soil in rain events. The southern part of the catchment also contains several higher order streams (multiple streams feeding into them) while the northern, north-eastern and western (Āwhitu Peninsula) parts of the catchment are dominated by shorter first and second order streams.

Āwhitu Peninsula has significant areas of less stable sandy loam soils on steeply sloped terrain making it inherently vulnerable to soil erosion – where stabilising vegetation has been removed (e.g. for pastoral farming). Several unique dune lakes can also be found along Āwhitu Peninsula.

Rivers are a primary transport pathway for multiple contaminants entering the harbour with inlets representing a transition zone between multiple rivers and the wider harbour. Theses inlets create an environment where river flows transition into the less turbulent tidal flow and dispersal of river flows is constrained by the width of the inlet. The river catchments feeding into the two southern inlets (Waiuku and Pahurehure) are of significant size with multiple higher order rivers. This results in a sizeable portion of overland flow being directed through the two inlets along with any contaminants that have been transported by these river networks.

Figure 2. Map of the Manukau Harbour and its hydrological catchment area.

Part 2: Drivers, pressures, state and impacts

Part 2 provides a high-level summary of the drivers, pressures, state and impacts information for the Manukau Harbour.

Drivers consider the overarching (global, national, regional and local) factors that influence change across the catchment.

The pressures section describes the main activities underway across the harbour and the main environmental pressures each activity can result in, depending on the way that activity is managed.

The state and impacts section describes readily, available catchment specific information about the Manukau Harbour state, change in state, and any known impacts of changes to the state of the harbour.

2.1 Drivers

Driving forces are the social, demographic, and economic forces driving human activities that increase pressures on the environment. The overarching drivers (described in Table 1) identified for the Manukau Harbour are:

- increasing atmospheric greenhouse gas concentrations
- national and local government policy settings
- population growth (Figure 3)
- local and overseas markets
- infrastructure and water services.

These drivers are influenced by broader global and national contexts. For example, macro-economic and geo-political changes and their subsequent influence on the environment, economies, and the movement of people. Some examples of global change that can influence the identified Manukau Harbour drivers include:

- international commitments to reduce greenhouse gas emissions
- large scale migration – for example, over a billion people are projected to be on the move globally by 2040, due to extreme and inhospitable living conditions as the climate changes[11]
- trade agreements, changes in consumer demand, changes in government, and major conflicts.

The environmental health of the harbour is influenced by how drivers play out at the harbour scale. Many drivers are outside the control of the council; however, Auckland Council is an influencer of many of local scale drivers for the Manukau Harbour. For example, regional decisions for environmental regulation, waste management, water services, land use zoning and transport infrastructure.

[11] Strategic Advice Unit 2024. Drivers of change: considerations when developing Auckland Council strategy, policies, and initiatives.

Table 1. Overarching drivers that influence pressures on the Manukau Harbour.

Driver	Description
Atmospheric greenhouse gas concentrations	Climate change is affecting our marine environments – resulting in increased sea-surface temperature, ocean acidification and rising sea levels.[12] People's use of fossil fuels and land use change globally has increased atmospheric concentrations of greenhouse gases (GHGs), which is driving a suite of climatic changes globally. Tāmaki Makaurau is already experiencing these changes. In marine environments the following changes are occurring: • increasing surface sea temperature • increasing ocean acidity • rising sea level • changes to existing climate patterns such as the El Nino Southern Oscillation. A time lag exists between greenhouse gas emitted today and climate impacts that result, meaning that some climate change impacts are already committed to, even though they won't eventuate for years to come. Beyond the already committed change – the trajectory of future climatic changes depends upon future greenhouse gas concentrations in the atmosphere. The National Institute of Water and Atmospheric Research (NIWA) used two scenarios in its regional climate projections for Tāmaki Makaurau[13]: • a 'mid-range scenario' in which GHG concentrations stabilise • a 'high end scenario' in which GHG concentrations continue to rise. The scale of change projected under either of these scenarios will result in a suite of climatic changes and disruption to our marine environments.[14]
National and local government policy settings	Decisions made by national and local governments directly impact people and their behaviour and subsequently pressures on the health of the harbour. For example, how the following are progressed: • supporting and enabling growth • regulatory settings for environmental management • regenerative infrastructure and nature-based solutions • investment in natural environment outcomes • acquisition and management of public open space • environmental research, monitoring, and information sharing. Policy settings have the potential to either increase or ameliorate pressures on the environment that result from Aucklander's use of and activities around the harbour. They can also result in inequitable outcomes for Aucklanders – where some people live in areas of high contamination and low natural environment compared to others.

[12] Ministry for the Environment and Statistics New Zealand 2022. Our marine environment 2022. New Zealand's environmental reporting series.
[13] Pearce et al 2018. Auckland region climate change projections and impacts. Revised January 2018. Prepared by the National Institute of Water and Atmospheric Research, NIWA, for Auckland Council. Auckland Council Technical Report TR2017/030-2.
[14] You can read more about climate change projections at the NIWA website. You can read more about climate related pressures on the marine environment at the Ministry for the Environment website.

Driver	Description
Population growth	About 1.65 million people live in the Tāmaki Makaurau region[15], of which about 397,000 people live in the Manukau Harbour catchment.[16] Most people live in the densely populated urban areas in the north and east of the catchment. There are several smaller urban areas in the south. The population of the Manukau Harbour catchment is relatively diverse, young, and increasingly born overseas. The urban area in the catchment increased by 16 per cent or around 2000 hectares between 1996 and 2018. Most of this growth has occurred around Puhinui, Papakura, and Pukekohe.[17] Growth continues to occur and updated estimates of the increase in urban area will be available in the next year. The population of Tāmaki Makaurau could increase by 650,000 by 2052[18], from 1.65 to 2.3 million people. Approximately 200,000 of these people are expected to live in the Manukau Harbour catchment. Increasing the population in the catchment to around 600,000 (Figure 3). 200,000 new dwellings are projected to be needed across Tāmaki Makaurau by 2032, with approximately one third of these projected be in the Manukau catchment. Around 9500 hectares of future urban land has been identified across the region; as well as intensification of existing urban areas.[19] Both urban expansion and intensification can result in a reduction in soil, green spaces and vegetation cover, and an increase in urban contaminants delivered to the harbour if not well managed. Growth can also provide opportunities to address legacy issues over time. The large, growing population of Tāmaki Makaurau requires the growth of services such as waste management, parks, schools and hospitals, transport and water networks and services, employment, and food. They also require opportunities for employment to support social and economic sustainability. Servicing a growing population can result in increased pressures on the health of the harbour. Individual choices and behaviour (e.g. recreation, waste disposal, outdoor water use) can further drive (or limit) pressures on the harbour.

[15] Statistics New Zealand 2024. New Zealand Census 2023.
[16] Based on census 2023 data.
[17] Auckland Council 2021. A synthesis of state of the environment monitoring in the Manukau Harbour.
[18] This represents a mid-range scenario. Population growth scenarios identify population growing to 1.8 million (very low) to 2.6 million (very high) by 2050.
[19] Auckland Council 2023. Future Development Strategy.

Driver	Description
Economic context: domestic and overseas markets	Global and local consumer demand can strongly influence land use in New Zealand and subsequently in the harbour catchment. Changes in demand can drive changes in land use activities. Demand for certain goods and services is being driven by global population growth and consumer preferences. Conflict, trade agreements and changes in government can also influence overseas and domestic markets. The catchment is valued and used most for pastoral agriculture and vegetable growing and urban industrial and residential land uses. Land cover in the harbour catchment is[20]: • 57 per cent pasture and exotic grasslands • 16 per cent urban • 12 per cent indigenous forest and 2 per cent indigenous shrubland[21] • 9 per cent cropping and horticulture • 2 per cent exotic forest and 1 per cent exotic shrubland • 1 per cent artificial bare surfaces. Aucklanders undertake many activities under these broad categories of land cover that can add pressures on the health of the Manukau Harbour. Auckland Council is responsible for ensuring sufficient allocation and distribution of land zoned for commercial activities, such as agriculture and businesses and light and heavy industrial activities, to match urban growth and community needs. A large proportion of the heavy industrial and light industrial zoned land in Tāmaki Makaurau is within the Manukau Harbour catchment and concentrated around the Māngere Inlet and in Manukau (i.e. near the international airport).
Infrastructure and water services	Extensive infrastructure has developed across many parts of the harbour catchment to provide essential services to Tāmaki Makaurau. Infrastructure can drive long-term changes to the coastal marine environment both during construction and with on-going use. Several examples include: • infrastructure placed in the harbour and/or along its coastline can alter hydrodynamics and remove habitat/species • the transport and stormwater networks together move contaminants from roads and other impermeable surfaces to the harbour • the discharge of treated wastewater contributes large volumes of nutrient to the harbour. Infrastructure around the harbour includes: • State Highways 1 and 20 • Westfield railway yards and railway corridors • Auckland Airport • the wider Tāmaki Makaurau transport roading network • drinking water dams and treatment plants (Upper and Lower Nihotupu dams, Lower Huia and Upper Huia dams, Huia water treatment plant, Onehunga water treatment plant[22]) • wastewater treatment and biosolids disposal serving most of Tāmaki Makaurau (Māngere Wastewater Treatment Plant and Puketutu Island biosolids disposal) • water and wastewater treatment serving smaller settlements (Pukekohe, Clarks Beach, Kingseat, and Waiuku) • water supply, wastewater, and stormwater pipe networks • Papakura channel Liquigas gas terminal in the harbour • electricity transmission network • multiple open and closed landfills

[20] Auckland Council 2021. A synthesis of state of the environment monitoring in the Manukau Harbour.
[21] Predominantly in the Waitākere Ranges Heritage Area.
[22] Onehunga Water treatment plant operation has been paused due to contamination in Onehunga aquifer.

Driver	Description
	• Onehunga wharf and boat ramps • public open space (e.g. coastal reserves, local parks, beaches). Over the next ten years the council group is investing regionally in existing network services and renewals, and new infrastructure. Planned investment includes: • $32 billion on transport • $22 billion on water, wastewater and stormwater • $2.73 billion on urban regeneration. Large-scale infrastructure projects planned for the Manukau Harbour catchment include: • Airport to Botany rapid transport busway and southern catchments alignment to deliver stormwater upgrades at the same time roading upgrades are made • Central Interceptor partially commissioned, and completion planned for 2026 • Huia water treatment plant upgrade • Redoubt Road reservoir expansion • Waiuku water treatment plant and wastewater treatment plant projects • urban regeneration in the town centres of Onehunga, Manukau (Puhinui catchment), Papatoetoe and Pukekohe • new infrastructure needed to support growth across the catchment • Waka Kotahi roading network services and renewals • the status of Waka Kotahi work on the East West Link motorway project and next steps following an investigation into a Manukau Harbour port feasibility study are unknown at the time of writing.

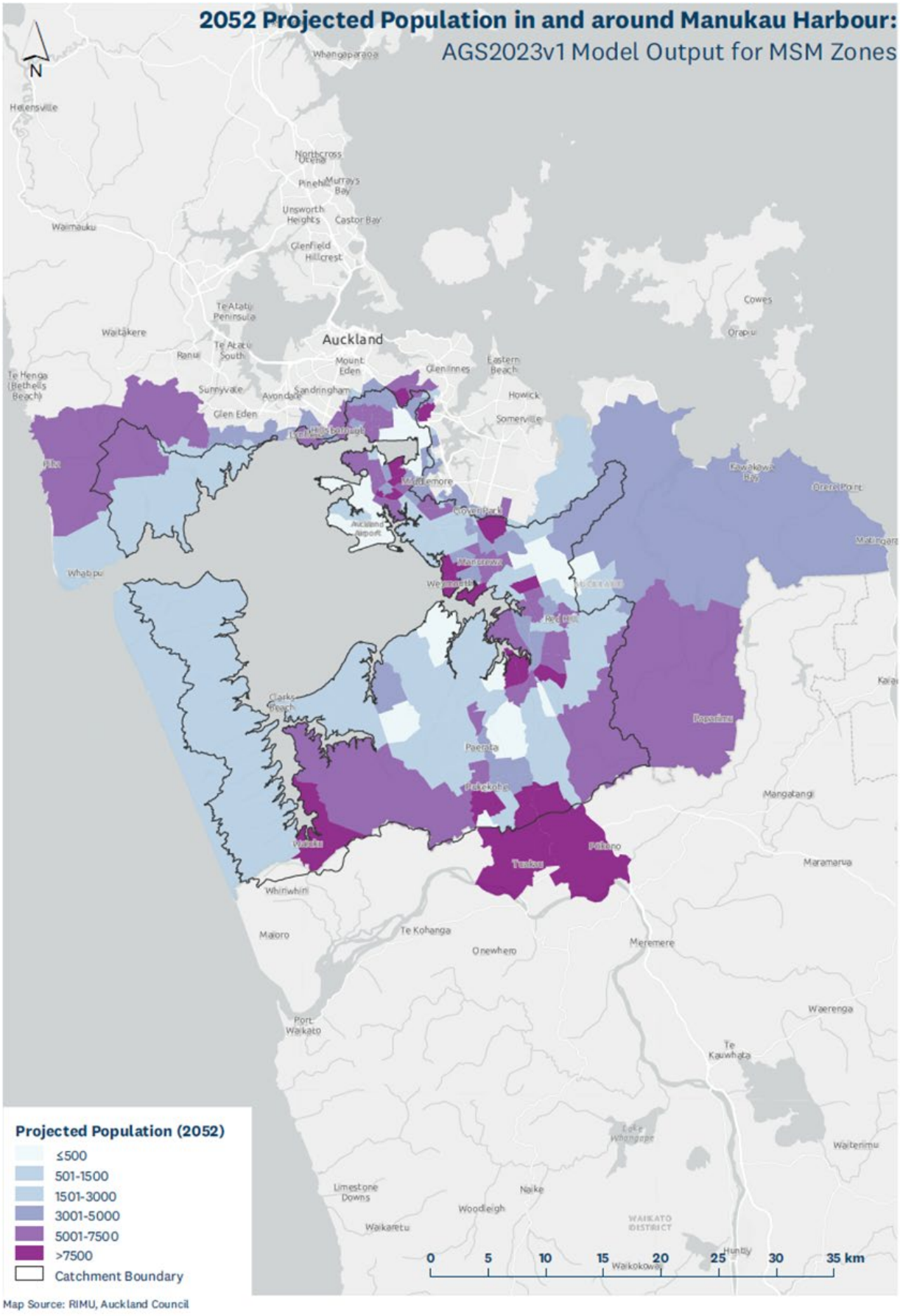

Figure 3. 2052 Projected population in Macro Strategic Model (MSM) zones, Auckland Growth Scenario 2023 v1.0.

2.2 Pressures

Pressures are the stresses placed on the environment by human activities. In this section the main activities that are present across the Manukau Harbour catchment are identified and potential pressures they can generate are identified in the following order:

- loss of natural systems (both terrestrial and marine)
- a range of contaminants from rural, urban and industrial activities
- invasive species and pathogens
- rubbish and microplastics
- climatic changes
- people's individual behaviours in and around the harbour e.g. littering, recreational activities, outdoor cleaning activities.

Many of the activities/pressures described have been occurring in the catchment for a long time.

Section 2.3 State and impacts provides more detailed information specific to the state of the Manukau Harbour, which indicates what pressures are having a measurable impact on the harbour today. Some pressures are the result of activities that occurred in the past. These are called 'legacy pressures'. Overtime people and the council group have improved the management of many of the activities that caused pressures in the past. Some of these improvements have resulted in measurable improvements to the state of the harbour. These are discussed in the next section 2.3 State and impacts.

Loss of natural systems

Historic loss of natural systems both in the harbour and around the harbour's catchment is well documented.

On land, the catchment has been cleared of 91 per cent of its original forest cover. The remaining 9 per cent is highly concentrated in the Waitākere Ranges in the north-west. 96 per cent of the original wetland extent has also been removed from the catchment. Watercourses and coasts have been modified in both rural and urban areas.[23]

In the harbour, seagrasses, salt marshes and mangrove ecosystems have all changed in extent over the last hundred years. Detailed information on changes and extent today is limited; however, information that could be found is included in the next section 2.3 State and impacts.

These changes all constitute the removal of habitats that provided important ecosystem functions within the harbour and its catchment that helped maintain a thriving harbour environment. These systems had roles including:

- the uptake and break-down of contaminants
- maintaining life supporting soil moisture and water temperature
- providing habitat for many species, including birds and fish
- retaining soils.

The loss of natural systems has occurred due to a range of activities, and in some cases – such as seagrass – is attributed to a disease rather than human activities.

[23] Auckland Council 2021. A synthesis of state of the environment monitoring in the Manukau Harbour.

The removal and modification of these systems has resulted in increased surface water flows that causes more stream erosion and resulting sedimentation.

These systems were made up of a diversity of life that also had intrinsic value, and specific values for mana whenua. The removal of natural systems and species continues today across all the areas noted above, as well as mangrove removal by people due to amenity benefits sought.

Rural land uses

The Manukau Harbour catchment is recognised for the significant role it plays in providing for the vegetable growing needs of the region and nationally because of its productive soils and climate. It is estimated that the Pukekohe growing area generates $327 million in revenue annually, which equates to about 26 per cent of New Zealand's total domestic value of vegetable production.[24] Livestock production is also an important land use and economic activity.

Agricultural performance is continually being improved, including environmental practises. However, these activities continue to result in the generation of a suite of potentially harmful inputs to the harbour. These include:

- nutrients from fertiliser application and livestock (i.e. urine)
- organic contaminants
- sediment from cultivation, earthworks, and highly erodible land.

Table 2. Pressures from rural land uses.

Pressure	Description
Fertiliser application & livestock	Artificial fertiliser use has underpinned significant increases in crop and pasture yields over the past 50 years, to the point that the financial viability of our food production systems are reliant on the use of fertiliser. However, over-application of fertilisers, especially nitrogen-based fertilisers, leads to the leaching of excess nutrients into freshwater (surface water or groundwater), which can subsequently end up in the harbour. Some vegetable crops require very high nutrient inputs and are high risk for nutrient leaching as a result. Intensive livestock grazing is also a contributor to nutrient leaching from farms due to the high nitrogen content of animal urine and faeces. Nutrients from animal urine and faeces can leach through soils in freshwater and groundwater directly from the paddock or as a result of managed 'effluent' discharges. Animal faeces and effluent can also contain phosphates and pathogens.
Chemical sprays	The use of chemical sprays to prevent, manage, and treat pests and diseases is also an integral part of primary production practice. At times, use of specific chemical sprays has occurred without a sufficient understanding of the spray's impacts and breakdown in the environment or its potential human health impacts.
Earthworks and cultivation	Earthworks and cultivation (turning of the soil) on farms can result in soils being picked up by water or wind and being deposited in the harbour. Vegetable production tends to be high risk due to the short growing rotations leading to regular cultivation and the lack of sustained vegetative cover for much of the year. Additionally, farm tracks and laneways on rolling to steep land can also be a contributor of sediment into streams during rainfall events.
Highly erodible land	Highly erodible land, once covered in native bush and scrub and now covered in pasture, also contributes to increased levels of sediment entering the harbour. This is of specific concern along the Āwhitu Peninsula where Red Hill and related sandy loam soils are predominant. The northern shoreline of the harbour – either side of Cape Horn – is also highly erodible and experienced significant land slippage during the 2023 Cyclone Gabrielle.

[24] Deloitte 2018. New Zealand's food story: The Pukekohe hub. Prepared for Horticulture New Zealand.

Urban land uses

Urban land uses – housing, transport, infrastructure construction and industrial activities – generate a range of contaminants that can be transported into the harbour and result in a range of pressures including sediments, heavy metals, organic contaminants, industrial chemicals, plastics and rubbish.

Contamination in the harbour from urban land uses are both a legacy and current issue.

Table 3. Pressures from urban land uses.

Activities	Pressures associated with this activity
Urban land use: existing infrastructure and new infrastructure to support growth	**Wastewater discharges** There are three wastewater treatment plants that discharge directly into the Manukau Harbour: Māngere Wastewater Treatment Plant (MWTP), and the Clarks Beach and Waiuku wastewater treatment plants. Māngere Wastewater Treatment Plant is the largest of these, processing around 85 per cent of the region's municipal wastewater before discharging ~390 million litres per day of treated wastewater directly into the harbour. Treated wastewater is released on the outgoing tide at a maximum rate of 25m^3/s. This ensures rapid mixing and dispersal. Potential contaminants from the treatment plant discharge include nutrients (nitrogen and phosphorus), heavy metals, and pathogens (bacteria, viruses and protozoa). It may also be a source of emerging contaminants[25] such as microplastics and pharmaceuticals passing through the treatment plant from households. The Māngere Wastewater Treatment Plant discharge has a high degree of compliance with the consent conditions attached to this discharge. However, the discharged water remains a source of nutrients and is believed to contribute to elevated nutrient levels in the coastal water around the discharge and Māngere Inlet.[26] The current discharge consent expires in 2032. **Wastewater overflows** Overflows[27] from the wastewater network can result in untreated wastewater entering the harbour. There are 22 engineered overflow points (EOPs) that can potentially discharge into the Manukau Harbour. Four discharge directly into the harbour and 18 discharge into other water bodies that flow into the harbour. Of the 22 EOPs, two sites have been recorded or modelled to overflow during wet weather conditions more than once per year, indicating a relatively low frequency of direct wet weather discharges. Dry Weather Overflows (DWOs) pose a greater environmental risk, as they are typically caused by blockages or breaks within the wastewater network. These uncontrolled overflows can occur at any point in the network, and while most discharge to land, pollution incidents involving stormwater networks or water bodies do occur.

[25] Emerging contaminants refer to chemicals that are not yet routinely monitored that have the potential to cause ecological and human health impacts. Sources include pharmaceuticals, personal care products, microplastics and industrial and agrichemicals. Many of these contaminants are not effectively removed by existing treatment processes.

[26] Auckland Council 2021. A synthesis of state of the environment monitoring in the Manukau Harbour.

[27] There are three types of wastewater overflows monitored by Watercare. Engineered overflows from pump stations and along the network (types one and two) help relieve pressure on the system, while directing spills away from private properties. These are designed to spill in wet weather, thus decreasing environmental impact as well as human health risk. Uncontrolled overflows from the wastewater network (type 3) pose a greater risk to the environment and public health as these are more likely to result in dry weather overflows (DWOs), spilling untreated and undiluted wastewater to the environment. Common causes of type 3 DWOs are: broken pipes, fat buildup, blockages of wet wipes/rags or roots. Type 3 wet weather overflows (WWOs) also occur as a result of a surcharging network during rain events. Uncontrolled overflows can spill from any point along the network and can result in discharges to land, stormwater or waterbodies.

Activities	Pressures associated with this activity
Urban land use: existing infrastructure and new infrastructure to support growth	Across the Tāmaki Makaurau region 4768 overflows were recorded during the 2023-24 reporting period (July to June), of which 64 (1.34%) resulted in a major pollution incident. In contrast, the 2022-23 period saw a significant increase in wastewater overflows (WWOs) due to the Tāmaki Makaurau flood events, resulting in 132 major pollution incidents (2.1% of overflows). In comparison, the catchment areas surrounding and feeding into the Manukau Harbour recorded three overflows classified as major pollution incidents during the 2023-24 reporting period. Additionally, 830 dry weather overflows (DWOs) were recorded within the same period, reflecting the ongoing challenges related to network blockages and maintenance issues. **Stormwater** The stormwater pipe network and overland flow paths collect rainwater that flows across the roofs, roads and other paved areas of the city and discharges this into streams and harbours. A wide variety of contaminants can enter the stormwater network when it rains because the stormwater network is connected to most of the paved surfaces in the urban areas of Tāmaki Makaurau. Contaminants include hydrocarbons, heavy metals, sediment, microplastics, litter, cleaning chemicals and other chemicals from roads, roofs and industrial and residential paved areas. The stormwater network is managed to achieve water quality outcomes and objectives set in stormwater network discharge consent (issued 2019) including 'healthy and connected waterways that provide for te mauri o te wai'. Te mauri o te wai can be translated as the life supporting capacity of water. This includes the waters of harbours. Stormwater in the network built prior to 2018 receives either no treatment, or variable degrees of treatment for small areas (such as raingardens or stormwater treatment ponds). From 2018, some[28] developments and redevelopments are required to have stormwater treatment. Overland flow paths, the low points in the land where water flows in larger rainfall events, can also transport contaminants directly to streams and the harbour. **Onsite wastewater** Onsite septic systems are commonly used to manage household wastewater at rural properties where the wastewater network is not available. These usually include tanks for storing and treating wastewater before being discharged into the environment through soak lines over a dedicated area. If septic systems are not maintained or cleared at appropriate intervals, or if the storage tanks become damaged over time, poorly treated or untreated wastewater can seep from these systems into the environment. This increases the risk of contaminants entering rivers or the harbour via groundwater. **Transport infrastructure** Transport infrastructure (roads, bridges, railway lines, wharves/jetties, boat ramps, Auckland Airport) increases pressures on life in and around the harbour, including: • noise that can impact wildlife and human wellbeing • contaminant build up on roads (sediment, metals, hydrocarbons) washed into the stormwater network or directly to waterways and the harbour • artificial lights at night that can disorient seabirds and wading birds[29] • disrupting harbour hydrodynamics where structures are placed directly in the harbour • removing habitat and displacing species when located on the coast or in the harbour, e.g. the Manukau Harbour crossing included reclamation. [30]

[28] High contaminant generating areas, as defined in the unitary plan, are generally required to treat stormwater.
[29] Heswall et al 2022. Artificial light at night correlates with seabird groundings: mapping city lights near a seabird breeding hotspot. *PeerJ* 10:e14237.
[30] OPUS 2006. State Highway 20: Manukau Harbour Crossing Project. https://www.nzta.govt.nz/assets/projects/mhc/resources/pdf/Vol2-PartC-Tech-Rept-App-15-Part1.pdf

Activities	Pressures associated with this activity
Urban land use: existing infrastructure and new infrastructure to support growth	**Landfills** There are potential environmental risks associated with open and closed landfills. There are numerous closed landfills around the catchment – many at the coast forming what is now reclaimed land. There are also several privately operated open landfills within the catchment. **Other hard coastal infrastructure** Hard coastal infrastructure (which may play an important role in protecting properties or roads) such as seawalls and groynes can add pressure to the harbour through impacts to coastal habitats as well as limiting or removing the ability for habitats to shift with environmental changes such as sea level rise. This is often referred to as coastal squeeze and impacts the resilience of these intertidal habitats to adapt to climate change. Hard infrastructure can also impact coastal geomorphic processes such as wave dissipation, which can increase coastal scouring when wave energy is displaced along the coast. This is most evident during storms where hard infrastructure can increase the scouring effect of waves.
Urban land use: residential and individual behaviours	Individual behaviour of people living around and visiting the harbour can collectively add several distinct pressures to the harbour that are not already covered by another pressure in this section. This list is not exhaustive – it identifies just a few examples of relevance. **Waste/littering** Littering and the illegal dumping of household rubbish occurs around the harbour. This can impact both amenity values, coastal habitat and add to marine litter in the harbour. Putting grease (oils/fats) into the wastewater system leads to pipe blockages and subsequent wastewater overflows – that if near the harbour could result in untreated wastewater reaching the harbour. **Pest plant and animal species** Individual private landowner's actions in relation to pest plant and animal species contributes to the presence or absence of these pressures around the catchment. For example, the degree to which private landowners take responsibility for pest plant species on their property. Pest animal species can escape, or are abandoned, by their owners. These are discussed in the invasive species section below. **Habitat disturbance** Recreation activities can disturb species around the harbour, especially wading birds and seabirds. For example, water sports (e.g. kite surfing) and dog walking in areas close to bird roosting sites can result in disturbance during important periods of rest or injury to birds due to dogs. **Heavy metals, microplastics and hydrocarbons** Heavy metals and microplastics accumulate on roads as a result of wearing of tyres and brake pads. Heavy metals (e.g. zinc) can also come from metal roofs. These contaminants enter the stormwater network when it rains and will ultimately be discharged to the marine environment. **Household chemicals** When used inappropriately, chemicals from people's outdoor activities (painting, cleaning, etc.) both at home and work can end up in the stormwater system, ultimately discharging to the marine environment.

Activities	Pressures associated with this activity
Urban land use: housing/building construction	Growth has been occurring and will continue to occur across the Manukau Harbour catchment. Building consents issued by council provide an indication of the scale of growth occurring within the catchment. 10,659 building consents were issued in the Manukau Harbour catchment (compared with 36,065 regionally) between March 2022 and February 2024 (Figure 4). Areas identified as growth focus areas in the council's Future Development Strategy (FDS) provide an indication of expected future growth. The following future growth areas in the harbour catchment are identified in the FDS: Blockhouse Bay, Mount Roskill, Māngere, Manukau node, and Pukekohe node, as well as signalled Future Urban Zones in: Ōruarangi, Puhinui, Takaanini, Drury-Ōpaheke, Pukekohe and Paerata, Glenbrook, and Clarks Beach. Building construction can result in the following: • land clearance • loss of soils and sedimentation due to earthworks • litter/rubbish around construction sites • light and noise levels that can affect species in and around the harbour • coastal squeeze if coastal buffers are not sufficient to allow for habitat movement with sea level rise • removal of coastal habitat and displacement of species • change to coastal amenity values and access. Pressures associated with infrastructure to support growth are noted above. Once in place, new urban areas represent a land use change, or land use intensification. This can result in the following: • a change from rural land use pressures to urban land use pressures on the harbour, which reduce some contaminants (e.g. sediment) but increase others (e.g. heavy metals and hydrocarbons) • limiting mana whenua access to the coastline and harbour where once access was unfettered • limiting the general public's access to the coastline and harbour.
Urban land use: industrial	In the past, waste from industrial and manufacturing activities discharged directly into Māngere Inlet. The harbour – and in particular Māngere Inlet – is still recovering from the impacts of these discharges, which occurred for nearly 100 years prior to the establishment of Māngere Wastewater Treatment Plant. Light and heavy industrial land uses still occupy a significant amount of coastal land along the harbour – around Māngere Inlet and along the south-east coastline, including Pahurehure Inlet. Industrial areas can be a source of multiple contaminants into the harbour, including heavy metals, plastics, and organic contaminants. These contaminants can be blown from sites or transported through the stormwater network. Additionally, some sites closer to the harbour edge can have discharge consents, allowing them to release contaminants directly into the coastal zone. Many recorded and potentially unrecorded contaminated sites are situated in industrial areas – particularly along the northern coast of Māngere Inlet. Identified contaminants include asbestos, hydrocarbons, and heavy metals.
Urban land use: artificial lights at night	Infrastructure (e.g. bridge and street lighting), industrial sites and buildings, and residential sites and buildings can all include use of artificial lights at night (ALAN). Lighting from the city at night can disorient wading and seabirds and cause them to get lost; and ultimately can cause death. ALAN at night can also affect community values, such as the ability to see the sky at night.

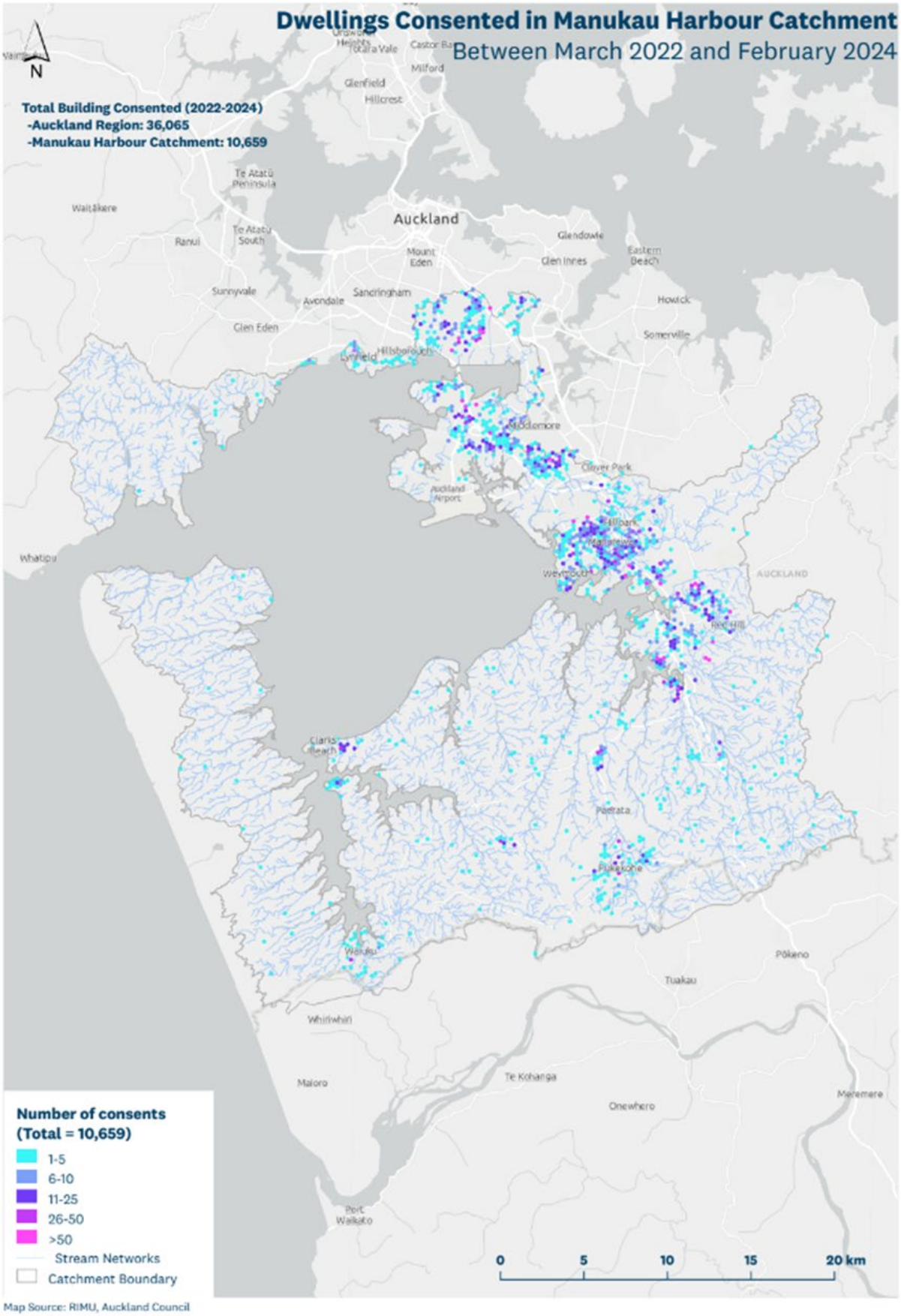

Figure 4. Building consents issued in the Manukau Harbour catchment between March 2022 and February 2024.

Invasive species and organisms

This section outlines the main marine and terrestrial invasive pests and diseases found around the Manukau Harbour. Climate change is expected to increase the likelihood of new marine invasive species arriving in coastal waters and is likely to increase the chances of establishment for some invasive species.

Table 4. Pressures from invasive species and organisms.

Pressure	Description
Marine invasive species	The introduction and spread of marine pests can negatively impact aquatic environments, causing ecological, economic, and social harm. They can predate on native species, outcompete others for space and food, and spread disease. Marine pests typically arrive in New Zealand at ports, transported as biofouling on hulls or in the ballast water of boats arriving from overseas, and once established, can spread further on vessels and equipment moved between harbours by recreational and commercial users.[31]
Freshwater invasive species	There are numerous freshwater and brackish water invasive species that are found in, or threaten, waters in and around the Manukau Harbour. For example, koi carp and gambusia can impact water quality and habitat that native species rely upon. Freshwater Golden Clam, which lives in both freshwater and brackish water, has not been observed in the harbour (or Tāmaki Makaurau) yet. The golden clam could outcompete native species in brackish waters and impact water quality.
Terrestrial invasive species	Introduced predators, including mustelids, rats, hedgehogs, and feral cats, can predate coastal birds and other species. Species that nest on these coastlines, such as tūturiwhatu (Northern New Zealand dotterel) and tōrea pango (variable oystercatcher), are particularly vulnerable to predation. Possums, rats, mice, and browsing species like deer, goats, and pigs can damage native ecosystems and prevent regeneration of native plants. This further reduces the filtering capacity and soil stabilisation of vegetation. Pest plants are present across the coastal edge and can overtake indigenous habitat. Canadian geese can build up in large numbers in the Manukau Harbour and can result in faecal contamination of coastal waters. Canadian geese can also be aggressive towards other bird species resulting in greater energy spent in flight, displacement from preferred roosting or feeding sites, and death in some cases.
Pathogens	New pathogens (viruses, bacteria, fungi) and their associated diseases are a constant risk that can add to the pressures on the harbour. Invasive pathogens such as myrtle rust and kauri dieback can impact coastal vegetation and forests, while other viruses can affect marine and bird species. The spread of toxoplasmosis from cats to marine mammals has been found to be affecting Māui and Hector's dolphins, including mortality.[32] Avian botulism is a disease that can cause paralysis and ultimately death. Birdcare (located on the northern shores of the Manukau Harbour) regularly treat native birds from the Manukau Harbour suffering from botulism.[33] High pathogenicity avian influenza (also known as HPAI or bird flu) is a highly contagious viral disease that could spread to Aotearoa New Zealand.[34] The HPAI H5N1 strain is causing significant impact on poultry, wild birds and mammals overseas.

[31] Auckland Council 2021. A synthesis of state of the environment monitoring in the Manukau Harbour.

[32] Roberts et al 2019. Spatial risk assessment of threats to Hector's and Maui dolphins (*Cephalorhynchus hectori*). New Zealand aquatic environment and biodiversity report no. 214. Fisheries New Zealand.

[33] Home - BirdCare Aotearoa.

[34] HPAI or high pathogenicity avian influenza | NZ Government.

Marine litter

Marine litter has been highlighted as a global issue affecting oceans, as well as Tāmaki Makaurau.[35] Marine litter refers to any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment. This includes materials:

- deliberately discarded onto beaches or into the sea
- brought indirectly to the sea by rivers, wastewater, stormwater or wind
- accidentally lost, including material lost at sea in bad weather.[36]

Sources and types of marine litter vary from location to location dependent on several factors such as ocean currents, proximity to densely populated areas, and waste management practises. Sources of marine litter around the Manukau Harbour include waste:

- escaping during municipal waste collection and processing (called 'leakage')
- escaping from business and industrial sites
- littering and illegal dumping (also called 'tipping')
- commercial and recreation activities on the water.

Climate change

As the climate changes marine species and ecosystem processes are expected to be impacted by the following: increasing water temperatures, rising sea levels, increasing ocean acidity, and changing weather and ocean currents. Coastal ecosystems are at risk of damage and inundation from sea-level rise and extreme weather events. Marine ecosystems and species are at risk from invasive species being able to spread and establish more widely.[37]

Table 5. Pressures from climate change.

Pressure	Description
Warmer marine water temperatures	Water temperatures are predicted to increase by ~1°C by mid-century (2050) and ~2.5°C by the end of the century (2090). This change may affect species growth rates, species survival, and species distribution. Intertidal mudflats and reefs are highly sensitive to increased water and air temperatures with many species already living close to their thermal limit. Increasing water temperatures also have the potential to alter an entire food web by disrupting the balance between producers, primary consumers, and secondary consumers.[38]
Ocean acidity	Ocean acidification, which affects the physical condition, reproductive physiology, and survival of marine species, is changing because of increased concentrations of carbon in our oceans.[32] In a large intertidal ecosystem such as the Manukau Harbour, increased ocean acidity has the potential to become a pressure on both the intertidal and subtidal ecosystems through impacts on the shell or skeletal development of crustaceans, larval survival of molluscs, and nutrient processing.[39]

[35] Auckland Council 2023 Auckland Waste Assessment 2023.
[36] United Nations Environment Programme: Marine litter | UNEP - UN Environment Programme.
[37] Ministry for the Environment 2020. National Climate Change Risk Assessment for Aotearoa New Zealand.
[38] Foley, M. M. and M. Carbines 2019. Climate change risk assessment for Auckland's marine and freshwater ecosystems. Auckland Council technical report, TR2019/015.
[39] Forest & Bird 2019. Ocean Acidification – Implications for New Zealand.

Pressure	Description
Sea level rise	Sea level is projected to rise by 0.2m–0.5m by 2050, and 0.4–1.34m by 2100.[40] Rising sea level will influence: • the viability of some habitats in some locations • coastal hazards, such as inundation and erosion • the freshwater marine interface.
Storm intensity	Tāmaki Makaurau is likely to have more intense, more frequent large scale storm events. Higher magnitude events can cause damage to coastal ecosystems (e.g. dunes), will cause higher sediment erosion into waterways and cause incision in streams. Stream bank erosion is already an issue across the region – increased storm intensity is expected to amplify slips and sedimentation.

How much sediment comes off the land into the harbour each year? And where does it come from?

Sediment generation across the catchment (generated from land) is estimated at 74,000 tonnes annually. Most of this comes from rural areas around the harbour and of this 70 per cent (51,500 t/yr) is estimated to come from gully erosion and pasture runoff.

Modelled sediment loads to the harbour (i.e. estimating how much sediment ends up in the harbour) indicate that the Pahurehure Inlet experiences the highest sediment loading and Puhinui Creek the second highest. Modelling for Māngere Inlet indicates low sediment input from the catchment (total mass) and yield (mass/m^2).

These models estimate sediment volumes entering the harbour from catchments annually and do not estimate the amount of sediment already in the harbour from previous years – or how sediment is building up or moving around the harbour over time.

How much nutrient comes off the land and into the harbour each year? And where does it come from?

Nitrogen loading across the catchment (generated from land) is estimated at 1282 tonnes annually – 93 per cent of this is generated in rural areas and 7 per cent in urban areas. Similarly, phosphorous loading of the catchment is estimated at 492 tonnes annually.

This estimate does not include the Māngere Wastewater Treatment Plant that discharges directly to the harbour. This adds approximately 894 tonnes of nutrients annually directly to the harbour.

Modelled total nitrogen concentrations in the harbour have been estimated to be highest near the Māngere Wastewater Treatment Plant discharge, near the Kingseat Wastewater Treatment Plant discharge at Clarks Creek, Pahurehure Inlet, and in the Taihiki River.

The information in this text box is sourced from the Freshwater Management Tool – stormwater catchment contaminant model and a 2024 unpublished report by NIWA, which modelled the nutrient and sediment sensitivity of estuaries in Tāmaki Makaurau applying the CLUES model.

[40] Based on SSP2-4.5 and SSP3-7.0 https://searise.takiwa.co/map/6245144372b819001837b900/embed.

2.3 State and impacts

Readily available information about the environmental state of the harbour is summarised to identify the degree to which the potential pressures outlined in section 2.2 'Pressures' are changing the state of the harbour and/or impacting life in the harbour. State refers to the physical, chemical, and biological condition of the harbour and how these characteristics are changing. Impacts refer to the ecological, economic, social, and cultural consequences of change in the state of the environment.

Monitoring of the state of the harbour does not match directly to a specific activity or pressure; however, overall changes and impacts in distinct areas of the harbour mean that likely causes can be indicated. This information is not intended to develop detailed management responses for specific activities/pressures, which would require more detailed information to ensure accuracy and confidence in the efficacy of the given management response. The intended application of this information is to identify priority focus areas for more detailed investigation.

The combination of catchment and harbour characteristics[41], proximity to a large population base and its mix of rural and urban land uses has resulted in a suite of land-based pressures (see Section 2.2) altering the state of the harbour and causing a variety of environmental, social, and cultural impacts.

State and impacts observed today result from historic as well as current activities. Land-based pressures are most evident along the coast and in the inlets of the harbour, and less evident further away from land. However, some issues – such as pathogens and microplastics – may be more prevalent throughout the harbour. Further, there is limited information about the state and impacts for subtidal areas meaning that a full assessment of state and impacts in these areas is not possible.

Activities to improve the harbour's health – e.g. to reduce urban impacts, have seen significant improvements to the management of land-based pressures over recent decades. State of environment monitoring is evidencing this change in the state of the harbour. However, several contaminants remain above recommended levels.

The degree to which pressures on the harbour influence a change in the state of the harbour and subsequently impact life or processes in the harbour is influenced to a large degree by the characteristics of the harbour.

Available information about Manukau Harbour environmental state and impacts are summarised in relation to the following topics:

- habitat (types, extent, and quality)
- species (types and abundance, invasive species)
- water quality (sediment, nutrient, faecal contamination, emerging issues)
- marine litter, illegal dumping, microplastics
- climate change.

Harbour characteristics

The Manukau Harbour covers a vast area – it is Aotearoa New Zealand's second largest harbour with a surface area of 365 km^2 and over 450 km of shoreline. The harbour has a mostly shallow basin with a deep narrow mouth that splits into four deep, narrow channels (the channels are shaded darker blue-grey in Figure 1).

[41] Examples of catchment and harbour characteristics include areas of steep slope, freshwater inflows, shallow harbour basin and high degree of tidal flushing in the main body of the harbour and less flushing in the harbour's inlets.

Over half the water in the harbour drains out between high and low tide, exposing around 62 per cent (226 km^2) of the harbour bed, which is made up of expansive sandflats and mudflats. This large daily movement of water is one of the fundamental drivers of what species, habitats and ecosystem processes have developed within, and around, the harbour.

The harbour has three large inlets, Waiuku, Pahurehure, and Māngere, as well as multiple smaller inlets. The sheltered and contained nature of these inlets result in greater settling of suspended sediments from the water column. This results in the inlets being more vulnerable to the impacts of sediment entering these areas as well as being more likely to accumulate contaminants over time.

The Manukau Harbour was formed approximately 10,000 years ago when sea level rose and drowned a large river valley system. The river that flowed through the valley had cut deeply incised river channels, which now form the harbour's four deep channels. The harbour was originally an open bay; the formation of extensive sand dunes along Āwhitu Peninsula has resulted in its current form as a sheltered harbour.[42]

Table 6. Manukau Harbour environmental state and impacts information.

Topic	State and impacts
Habitat	The Manukau Harbour encompasses extensive, interconnected coastal and marine habitats that support a diversity of life. Habitats include subtidal areas, intertidal sand and mudflats, shell banks, rocky reef, seagrass, salt marsh, mangroves, and a variety of coastal (land-based) habitats. The state of habitats across the harbour varies by location and habitat type. In some areas habitats are in good health, while in other areas the impacts of land-based pressures are evident. Based on existing, readily available information – the key concerns are: • sedimentation in the harbour's inlets, which has resulted in lower diversity of benthic species – reducing ecosystem resilience and food availability for fish and bird species • a range of pressures on bird habitat, including invasive weeds, recreation activities, and in some specific areas high sedimentation is causing mangrove[43] expansion into new areas of the harbour that can disrupt wading bird feeding and roosting behaviours • historic loss of key habitats such as sea grass, salt marsh, wetlands, and forests • coastal modification (e.g. coastal reclamation and development), which can completely remove coastal habitats and associated life and alter coastal processes • sea level rise and other climate change related impacts on coastal habitats, such as shellbanks. Copper, lead, arsenic, mercury, and organic contaminants[44] are not found in concerning levels in the Manukau Harbour and have not been found to be increasing in the harbour over recent years. However, zinc is elevated at two monitored sites in the Māngere Inlet[45], this is most likely from legacy inputs and has been observed to be decreasing over time. The availability of information about habitat state and impacts is highly variable. Long-term monitoring information about intertidal sand and mudflats is readily available; however, there is limited information about the state and impacts of other habitat types in the harbour. Planned habitat mapping of the harbour in 2025 will provide updated information on habitat extent.

[42] Auckland Regional Water Board 1990. Manukau Harbour Water Quality Management Plan.
[43] Mangroves are an important indigenous species and provide an important habitat in many areas of the harbour. See section on mangrove habitat on page 30 of this document.
[44] Organic contaminants monitored are polycyclic aromatic hydrocarbons, organochlorine pesticides and polychlorinated biphenyls.
[45] Out of a total of 27 monitored sites in the Manukau Harbour.

Topic	State and impacts
Habitat	**Sand and mudflats** About 62 per cent of the harbour is intertidal[46] sand and mudflats. Many of these areas are abundant with benthic[47] life, which: • provides a rich food source for many bird and fish species • contribute to ecosystem processes (e.g. nutrient cycling)[48] • provide food for people. Much of the harbour's sand and mudflat habitat is considered in good health – with monitoring results finding consistently good health (low sediment, high diversity of benthic species) for sites in the main body of the harbour. However, the quality of these habitats is poor in many of the harbour's inlets due to the build-up of sediment on the harbour floor. Locations with high sediment content are observed to have lower diversity of benthic species, which reduces ecosystem resilience and food availability. The estuary floor has high mud content (sediments) in all the main inlets. Whereas monitoring sites on the sandflats out in the main body of the harbour all have low mud content (sediments) – except for Clarks Beach, which has had variable mud content over time. Increased muddiness has been observed at the Clarks Beach[49] sandflat monitoring site, indicating that the sand and mudflats in the main body of the harbour can be – at times – impacted by sediments entering the harbour from surrounding land use activities. There is a potential that occasional sediment increases such as this could affect benthic communities in the main harbour.[50] Copper, lead, arsenic, mercury, and organic contaminants[51] are not found in concerning levels in the sediments (of sand and mudflat monitoring sites) of the Manukau Harbour and have not been found to be increasing in the harbour over recent years. However, zinc is found above recommended levels at two sites in Māngere Inlet.[52] Sources of zinc include industrial activities and run off from some building materials. Ongoing monitoring will confirm if zinc concentrations (along with other heavy metals) are stable, continuing to reduce, or building up. Arsenic and Mercury have been observed at levels that are not expected to impact upon life in the harbour. For the most part, arsenic and mercury concentrations have remained stable between 2005 and the most recent monitoring between 2016 and 2021; however, several sites in the Pahurehure Inlet showed mercury levels most likely increasing. The study cautions that the preliminary trend analysis indicating the increase is limited and additional analysis is required to establish a robust assessment of change over time.[53]

[46] Harbour floor that is exposed at low tide.
[47] Species that live in and on the sea floor.
[48] Nutrient cycling is the process by which nutrients are transformed from one state into another – such as in the process by which food is decomposed into the soil and nutrients transformed into a state that other plants can uptake to support their growth.
[49] An state of environment monitoring site in the main body of the harbour that is usually found to be in good health.
[50] Drylie 2021. Marine ecology state and trends in Tāmaki Makaurau / Auckland to 2019. State of environment monitoring. Auckland Council technical report, TR2021/09.
[51] Organic contaminants monitored include polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs).
[52] Mills and Allen 2021. Marine sediment contaminant state and trends in Tāmaki Makaurau / Auckland 2004-2019. State of the environment reporting. Auckland Council technical report 2021/10.
[53] Allen H 2023. Arsenic and mercury in marine sediment: state and preliminary trends in Tāmaki Makaurau / Auckland 2012-2021. Auckland Council technical report 2023/14.

Topic	State and impacts
Habitat	**Shellbanks** The Manukau Harbour has a series of internationally important shellbank habitats that provide roosting and resting areas for wading bird species. A small number of these shellbanks are being abandoned by wading birds due to the build-up of sediment in these areas encouraging the growth of mangroves. Mangroves can reduce the feeding areas and open space these birds require. Information about the extent or change in extent or quality of shellbanks is not readily available.[54] **Seagrass, salt marshes, and mangroves** The harbour also supports seagrass beds, salt marshes and mangroves, which support various species that rely on these habitats for food and shelter. In 1990, the estimated extent of these habitats combined was 11.3 km^2, which represented about 5% of the intertidal area of the harbour at the time.[55] Seagrass mostly grows on the open intertidal sandflats of the harbour. Seagrass extent in the harbour underwent large scale decline in the 1960s. A possible cause of the decline is infection by a fungus (Labyrinthula) that has affected seagrass globally. The estimated extent of Manukau Harbour seagrass beds in the 1970s was 1.7 km^2 (about 1.2% of the intertidal area and 19% of the total vegetated area of the harbour). Most of this was found in the area between Clarks Beach and Seagrove. More recent reports have indicated intertidal seagrass areas have been recovering[56]; however, information about how much change is occurring is not available. However, subtidal seagrass has not been observed to be recovering.[57] Saltmarsh is also believed to have declined since the European settlement of Tāmaki Makaurau. Saltmarsh extent in the 1970s was estimated at 91 hectares. Current extent is not documented. Mangroves are another important habitat of the harbour. Mangrove extent has been increasing in Māngere Inlet, Pūkaki/Waokauri Creek, and Puhinui Creek over the period 1996-2017. This may be occurring because of the build-up of sediment in areas where mangroves have not usually been present.[58] Removal of mangroves is being undertaken at Pahurehure inlet, Clarks Beach, Waiuku/Taihiki River and Āwhitu Peninsula, which has resulted in a net reduction in mangrove extent in those specific areas over the period assessed. Sedimentation in these areas may be limiting the recovery of other habitats or species in the areas where mangroves are removed. **Coastal modification** The northeastern coastline of the harbour has been extensively modified. The degree of coastal modification is an important indicator of harbour health.[59] Quantification of the degree of coastal modification around the Manukau Harbour is not available, although historical aerial photos show significant change (e.g. Pikes Point).

[54] Pers com 2025. Leighton Simmons, Conservation Advisor – Environmental Services. Auckland Council.
[55] Auckland Regional Water Board 1990. Manukau Harbour Action Plan: Manukau Harbour Water Quality Management Plan.
[56] Drylie 2021. Marine ecology state and trends in Tāmaki Makaurau / Auckland to 2019. State of environment monitoring. Auckland Council technical report, TR2021/09; Turner et al 1999. Seagrass patches and landscapes: the influence of wind-wave dynamics and hierarchical arrangements of spatial structure on macrofaunal seagrass communities. Estuaries 22: 1016-1032.
[57] Pers com. 2025. Megan Carbines, Lead Scientist – Environmental evaluation and monitoring unit, Auckland Council.
[58] Drylie et al. 2023. NPS-FM Coastal Connections: Supporting evidence for linking the NPS-FM programme to the coast. An internal working report for the National Policy Statement for Freshwater Management implementation programme.
[59] Stevens et al. 2024. Advice on indicators, thresholds and bands for estuaries in Aotearoa New Zealand. Salt Ecology report 141, prepared for the Ministry for the Environment, June 2024.

Topic	State and impacts
Species	The Manukau Harbour supports a diverse range of species including a variety of birds, finfish, shellfish, and marine mammals. Published information about fish, shellfish and marine mammal populations and the impacts of land-based pressures on those populations in the harbour is limited. The following section highlights a few key points from information that was available. Mana whenua have reported alarming declines of marine species in the harbour over several decades[60] resulting in enduring impacts on their communities. Further reductions in species' populations will continue to impact mana whenua and their relationship with their tupuna (ancestor)[61] and traditional food harvesting grounds. **Birds** The Manukau Harbour is recognised as a nationally and internationally significant bird habitat because of the numbers and diversity of species present; as well as the high numbers of endemic and threatened species present. More than 30,000 wading birds are believed to feed on the mudflats across the harbour daily and roost in areas near the Māngere Wastewater Treatment Plant and Karaka. The harbour supports more than 20 per cent of Aotearoa's wading bird population. The harbour contains multiple 'hotspots' for national critically endangered and vulnerable bird species including the Northern New Zealand Dotterel. Many wading bird species are threatened with declining populations. Some of the pressures threatening wading bird species occur when they are in other parts of the country or overseas. However, while located in the Manukau Harbour wading bird species experience the following threats: • predators (feral cats, mustelids, rats, hedgehogs, black-backed gulls, harriers) • habitat loss • mangroves and pest plants encroach on roosting and feeding areas and can conceal predators • sedimentation of feeding grounds and prey • climate change impacts such as heat stress, shifting migration timing, more frequent storms, sea level rise and king tides encroaching on bird feeding and roosting grounds • nutrient, plastics, and other contaminants reducing water quality and food availability • disturbances from people and boat use • artificial lights at night, which can disorient birds • disease (e.g. botulism and, in the future, High Pathogenicity Avian Influenza). Energy spent avoiding predators has a detrimental effect on wading birds. This is particularly so for migratory species that need to store up energy for long flights. There are also multiple wading bird species that have increasing populations with the support of habitat and pest management. These conservation efforts are critical to ensuring bird populations continue to increase.[62] Seabirds also frequent the harbour for feeding, roosting, and breeding depending on the species. Many seabird species are in decline and face a similar range of threats as wading birds (listed above). Threatened species of seabird that frequent the Manukau Harbour include the black-billed gull, red-billed gull, little penguin, Caspian tern, white-fronted tern, and the little black shag.

[60] Waitangi Tribunal 1985. Findings of the Waitangi Tribunal on the Manukau Claim (Wai 8).
[61] The Manukau Harbour and the life within it are genealogically connected to mana whenua today.
[62] Woolly et al. 2024. Conservation status of birds in Tāmaki Makaurau / Auckland. Auckland Council technical report, TR2024/5.

Topic	State and impacts
Species	**Finfish** A diverse range of fish, shellfish and marine mammals live in and frequent the Manukau Harbour. The Manukau Harbour supports fish species of commercial, recreational, and cultural importance. This includes fish that spend their entire lifecycle within the harbour (e.g. flounder) and those who mainly use the harbour as a juvenile nursery ground or seasonal feeding ground (e.g. snapper and rig).[63] Many species in the harbour are managed through the fisheries management system administered by Fisheries New Zealand. Commercially fished species populations are believed to be relatively stable. Declining catch rates for yellow belly flounder since the 1990s may be indicative of a declining population, although flatfish species are also known to be highly variable in abundance. Morrison et al (2023) emphasise the role that estuaries play in supporting finfish populations as they play an important nursery role for juvenile fish. They also note that the Manukau Harbour probably once played a much greater role in the west coast North Island snapper fishery; however, loss of biogenic habitat (e.g. living habitat such as horse mussel and seagrass – especially subtidal seagrass) may have severely reduced its role as a nursery environment for juvenile snapper.[64] Sharks and rays also regularly use the harbour, including short tail stingray, long tail stingray, New Zealand eagle ray; and several species of shark including the Great White Shark (vulnerable status).[65] **Shellfish** The harbour's waters are home to scallops, oysters, horse mussels, pipi, and cockle. Information about most shellfish species is limited; however, pipi and cockle numbers have been monitored at Mill Bay on the northern shoreline since 2000 and Grahams Beach at the north-east end of Āwhitu peninsula since 2006. Mill Bay had very low numbers of pipi and cockles between 2000-2015. In 2018, Grahams Beach had very low pipi and cockle numbers, with large (>50mm) pipi being almost entirely absent.[66] Low numbers of shellfish have been observed at these monitored locations. It is expected that shellfish and finfish populations are impacted by degraded habitats and reduced food availability in the harbour's inlets where sedimentation and resultant poor benthic health is evidenced. **Marine mammals** Marine mammal species frequent the harbour, including multiple threatened species. Threatened marine mammal species known to visit the harbour include Māui dolphin (nationally critical status), orca (data deficient status), bottlenose dolphin (nationally endangered status), and southern right whale (nationally vulnerable status).[67] Maui dolphins are of particular concern with an estimated population of between 48 and 64 dolphins. Toxoplasmosis is a threat to Maui dolphins[68] and is discussed in the next section on invasive species and pathogens. The harbour is also known to support many other species of marine mammal including the New Zealand fur seal and common dolphin.

[63] Auckland Regional Water Board 1990. Manukau Harbour Water Quality Management Plan.
[64] Morrison et al. 2023. Land-based effects on coastal fisheries and kaimoana and their habitats – a review. New Zealand Aquatic Environment and Biodiversity Report No. 309.
[65] Auckland Council 2018. Big Blue Waitākere; Coastal and Marine Information Report Big Blue Waitākere.
[66] Berkenbusch & Hill-Moana 2023. Intertidal shellfish monitoring in the northern North Island region, 2022-23. New Zealand Fisheries Assessment Report 2022-23: https://www.mpi.govt.nz/dmsdocument/57925-FAR-202332-Intertidal-shellfish-monitoring-in-the-northern-North-Island-region-202223/sitemap.
[67] Auckland Council 2018. Big Blue Waitākere: Coastal and Marine Information Report.
[68] Department of Conservation https://www.doc.govt.nz/nature/native-animals/marine-mammals/dolphins/maui-dolphin/facts/ (accessed 28/11/2024).

Topic	State and impacts
Species	**Invasive species and pathogens** A 2019 survey of the harbour found that it does not have any primary invasive marine species of concern listed by Biosecurity New Zealand. It does have one secondary invasive marine species of concern – the Asian date mussel.[69] The 2019 survey found fifteen non-indigenous species present, five of which were observed in the previous survey in 2006. All species detected have known populations in Tāmaki Makaurau, except for the colonial ascidian (e.g. sea squirts) *Polyandrocarpa zorritensis*. Other non-indigenous marine species present in the harbour include Asian paddle crab, Pacific Oyster and *spartina* grass. The Asian date mussel can form a dense mat along soft sediment which can displace native species and alter the community composition around soft sediment habitats. The Asian paddle crab is very aggressive, displacing native crabs (pāpaka) and preying on a variety of native species including shellfish, fish, other crustaceans and polychaete worms.[70] Pacific oysters alter ecosystem processes and can displace indigenous species (e.g. rock oyster), as well as impacting upon people's access to the harbour due to their sharp shells. *Spartina* destroys intertidal zonation and habitat, and smothers tauranga mātaitai shellfish beds thereby preventing kaimoana harvesting. The freshwater invasive species koi carp and gambusia are widespread in lowland regions across the region, including the Manukau Harbour catchment. These species impact water quality (e.g. increase sediment and nutrient in the water column through resuspension as they feed) and habitat that native species rely on. Terrestrial invasive species put pressure on coastal habitats and bird species – this includes possums, mustelids, and feral cats. Further investigation is required to assess the level of threat and management required; however, these pests are managed through the Regional Pest Management Plan and are actively managed on public land around the harbour. Concern is growing that High Pathogenicity Avian Influenza will reach New Zealand at some stage via migratory bird species, as it has now reached Antarctica. New Zealand has been preparing in case the H5N1 strain arrives here. Toxoplasmosis is a confirmed cause of death in Hector's and Māui dolphins. It is estimated that ~2 Māui dolphins annually are killed by toxoplasmosis along the west coast of the North Island. Toxoplasmosis impacts dolphin reproduction, behaviour and mortality. Toxoplasmosis is transferred to dolphins from cats when cat faeces end up in wastewater or freshwater flows that discharge to the marine environment. The highest concentrations of toxoplasmosis in the marine environment were estimated to be in winter along the west coast of the North Island where Māui dolphin are most abundant.[71]

[69] Tupe, M., C Woods, S Happy and C Boyes (2020). Manukau Harbour targeted marine pest survey May 2019. Auckland Council technical report, TR2020/003.
[70] Auckland Council Regional Pest Management Plan, section 7.7: Regional marine programmes. rpmp-section-7.7-regional-marine-programmes.
[71] Roberts et al. 2019. Spatial risk assessment of threats to Hector's and Māui dolphins (*Cephalorhynchus hectori*). New Zealand aquatic environment and biodiversity report no. 214. Fisheries New Zealand.

Topic	State and impacts
Water quality	Overall water quality in the Manukau Harbour has been assessed as 'poor' at four sites, 'marginal' at five sites, and 'fair' at three sites. Poor and marginal water quality was observed in and close to the harbour's three main inlets: Waiuku, Pahurehure, and Māngere. 'Fair' water quality was observed in the harbour channels.[72] Poor water quality scores in the Manukau Harbour are due to low water clarity (i.e. elevated sediments), elevated nutrient levels, high algae concentrations and at times low dissolved oxygen levels. Overall, water quality in the Manukau Harbour is poorer than the Waitematā and Kaipara harbours. Even so, water quality in the Manukau Harbour is better today than it was 30 years ago.[73] **Sediment** Sediment concentrations[74] in coastal waters are low in the main body of the harbour and elevated in the harbour's main inlets. Sediment in harbour surface waters has been found to be low (consistently below reference levels) in the four monitoring sites in harbour channels. At monitoring sites in and at the entrances to harbour's inlets it has been found to be elevated.[75] **Nutrients** Nutrient concentrations (nitrogen and phosphorus) were elevated at nine out of the 12 water quality monitoring sites in the Manukau Harbour over the period 2017-2022. These sites are all in or close to the harbour's three main inlets: Māngere Inlet, Waiuku Inlet, Pahurehure Inlet. The highest nutrient levels recorded (over the period 2017-2022) were at sites closest to the discharge from the Māngere Wastewater Treatment Plant. Those sites are at: Puketutu Point, Māngere Bridge and Te Whau Point. Nutrient concentrations near the Māngere Wastewater Treatment Plant discharge were very high prior to 2002. An upgrade to the treatment plant that introduced much higher levels of treatment of the wastewater prior to its discharge into the harbour has resulted in the largest improvement to water quality in the harbour over the last 37 years. As a result, nutrient concentrations in the north of the harbour (at monitoring sites close to the Māngere treatment plant discharge) reduced dramatically over the period 1998-2002 and continued to decrease over 2002-2008. However, nutrient levels at these monitoring sites remain above reference levels. The ecological impacts of elevated nutrients (i.e. algal blooms and eutrophication) in the harbour are not regularly observed. This may be because sediment in the waters of the harbour (where nutrient is also elevated) mean that algae don't have enough light to grow. In the southern parts of the catchment, shallow volcanic aquifers in the Pukekohe and Bombay areas have high concentrations of nitrates (well above National Bottom-Line limits) as a result of decades of intensive fertiliser use.[76] These two aquifers provide base flows for multiple spring-fed rivers and streams that connect to the harbour via the two southern inlets (Waiuku and Pahurehure). The time it takes for these nitrates to pass through the aquifers and into the streams (residence time) is 16 years (Pukekohe aquifer) and 36 years (Bombay aquifer) meaning that reducing high nitrate concentrations in these streams is expected to take decades.

[72] State of environment monitoring of coastal water quality measures water clarity, solids, algae, nutrient concentrations, and dissolved oxygen at 12 locations around the harbour. A single score based on all the measured parameters is created for each monitoring location, called the water quality index. Each score corresponds to one of four water quality ratings: good, fair, marginal, or poor - Coastal and estuarine water quality in Tāmaki Makaurau / Auckland: 2021-2022 annual data report - Knowledge Auckland.
[73] Auckland Council 2021. A synthesis of state of the environment monitoring in the Manukau Harbour.
[74] Auckland Council monitors 'turbidity' and 'total suspended solids' – neither of which directly measure sediment concentrations but are considered adequate indicators of sediment being in the water.
[75] Reference levels identify the level above which a contaminant becomes concerning. Reference levels are set based on an understanding of the impacts of the given contaminant on environmental health.
[76] Morgenstern et al 2023. Groundwater and surface water conceptual flow from environmental tracer signatures in the Pukekohe and Bombay area. GNS Science Report 2022/63.

Topic	State and impacts
Water quality	**Faecal contamination** Most beaches assessed in the Manukau Harbour are safe for swimming. Five beaches remain unsafe for human contact recreation. Faecal material can end up in coastal waters when stormwater and wastewater networks and septic systems overflow, leak or break down. This can make the water high risk for swimming and other recreational activities that involve getting into the water and/or putting your head under water. Auckland Council assesses 29 popular swimming locations around the harbour. Of these, 24 sites are assessed as low risk for swimming and five sites are indicated as not suitable for swimming. These are: Fosters Bay, Green Bay, Lynfield Cove, Granny's Bay, and Weymouth. This is an improvement on recent years as works have been undertaken to improve sites that were found to be high risk for swimming. For example, a broken wastewater pipe was repaired at Laingholm Beach, after which the long term no swim alert was able to be removed in 2021. **Impacts** The harbour's inlets are the most sensitive to and affected by freshwater inputs and point source discharges into the harbour. They are estimated to receive both the highest concentrations of contaminants from land-based activities, as well as having the lowest capacity to assimilate those contaminants. Sedimentation has reduced biodiversity and ecosystem function in the harbour's inlets. The harbour's inlets are all very muddy and this is impacting 'benthic' health[77] at all monitoring sites in the inlets – which score 'poor' or 'marginal'.[78] Benthic health is good where mud content is low – at all monitoring sites out on the harbour's sand flats. Manukau Harbour has one site that scores excellent for benthic health – to the south of Auckland Airport. Excess sediment (i.e. mud) in the water can disrupt fish feeding and reproduction.[79, 80] As sediment builds up on the estuary floor it can smother life causing reduced biodiversity and ecosystem functions.[81, 82] Algal blooms and subsequent eutrophication that would be expected with the levels of nutrient observed are not regularly occurring around the harbour. This may be because algae do not have enough light to grow in areas where nutrient is high because sediment is also high in those areas of the harbour. Sediment and faecal contamination impact the full suite of mana whenua values for the harbour. Faecal contamination at popular swimming beaches impacts on people's ability to safely access and enjoy the harbour for recreation.

[77] Benthic health refers to the state of species that live in and on the floor of the harbour.
[78] Auckland Council identify a combined health score for benthic ecology in the Manukau Harbour at 30 locations. The index results in one of the following scores for each location monitored: excellent, good, fair marginal, or poor.
[79] Ellis et al. 2002. Determining effects of suspended sediment on condition of a suspension feeding bivalve (Atrina zelandica): results of a survey, a laboratory experiment, and a field transplant experiment. Journal of Experienced Marine Biology and Ecology, Vol 267, Iss 2, 2002.
[80] Lowe et al. 2015. Harmful effects of sediment-induced turbidity on juvenile fish in estuaries. *Mar Ecol Prog Ser Vol.239: p241-254, 2015.*
[81] Zabarte-Maeztu et al. 2020. Effects of Fine Sediment on Seagrass Meadows: A Case Study of *Zostera muelleri* in Pāuatahanui Inlet, New Zealand., Journal of Marine Science and Engineering, 2020.
[82] Drylie 2021. Marine ecology state and trends in Tāmaki Makaurau / Auckland to 2019. State of the environment monitoring. Auckland Council technical report, TR2021/09.

Topic	State and impacts
Marine litter, waste and microplastics	Data about marine litter, dumped waste and microplastics is limited. This section summarises available information to provide a starting point for considering these issues in the Manukau Harbour. Data about litter in the waters of the Manukau Harbour is not available. However, Sea Cleaners collected 49,200 litres of rubbish from the Manukau Harbour in 2023, and a total of 1.5 million litres since collection began in 2002.[83] Litter Intelligence monitoring by citizen scientists on the beaches of Tāmaki Makaurau indicate the following: • plastic is the most found litter item on Tāmaki Makaurau beaches • several sites close to Onehunga and Māngere (urban areas) have had high litter densities, for example, 1700 items per 1000m^2. The national average is 405 items per 1000m^2 • other sites located around the Manukau Harbour have exhibited a range of litter densities.[84] Auckland Council cleans up approximately 1600 tonnes of illegally dumped items across the region every year. The most dumped items include tyres, mattresses, green waste, cardboard, whiteware, electronic items and bags of clothing and household rubbish. Microplastics have been found to be in comparatively high concentrations (more than 1000 pieces of microplastic per m^2) in Manukau Harbour sediments, compared to east coast beaches.[85] 88 per cent of microparticles found are fibres (i.e. from clothing) and two thirds of the fibres were plastic based. The findings of this study indicate that a main source of microplastics pollution could be from clothes washing.[86] Plastics and other rubbish: • breakdown to microplastics over time, releasing toxins as they breakdown • threaten wading and seabirds and marine life who can die from ingesting plastics and entanglement in plastics • disrupt the functioning of microbial life in the seafloor (‘microphytobenthos’) • can impact upon mana whenua values and associations with the harbour • can cause a safety risk to people, as well as impacting people’s enjoyment of the harbour.

[83] Sea Cleaners | We remove rubbish from the Sea, Harbours and Oceans.
[84] Litter intelligence data platform www.litterintelligence.org.
[85] Bridson et al. 2020. Microplastic contamination in Auckland (New Zealand) beach sediments. Marine Pollution Bulletin 151 (2020).
[86] Scion - Fibres dominant in microparticle contamination on Auckland beaches.

<table>
<tr><th>Topic</th><th>State and impacts</th></tr>
<tr><td>Climate change</td><td>
Climatic changes of most concern for the Manukau Harbour are:

increasing sea surface temperatures
decreasing ocean pH and nutrient concentrations
sea level rise
alterations to current and wind patterns
increased extreme rainfall events.[87]

These changes are already occurring and are projected to continue changing over the century and beyond. How much change occurs in future depends on how fast and how much greenhouse gas concentrations increase.
<table>
<tr><th colspan="3">Sea surface temperature (annual average)</th></tr>
<tr><th>Increase between 1982–2023[88]</th><th>Mid-century (2050)</th><th>End-of-century (2090)</th></tr>
<tr><td>Tasman sea
+0.8–1.2°C

Western North Island coastal waters
+0.6–1.5°C</td><td>1°C increase above present day (1976–2005)[81]

(using RCP 8.5[89])</td><td>2.5°C increase above present day (1976–2005)[81]

(using RCP 8.5)</td></tr>
<tr><th colspan="3">Sea level rise</th></tr>
<tr><th>Today</th><th>2050</th><th>2100</th></tr>
<tr><td>Approximately +26.7cm since 1900[90]

Increasing at a rate of ~2.5mm/yr since 1961</td><td>+0.5 metres above present day (1986–2005 mean sea level)

(using RCP 8.5)</td><td>+1 metre above present day (1986–2005 mean sea level)

(using RCP 8.5)</td></tr>
<tr><th colspan="3">Ocean pH</th></tr>
<tr><th>Today</th><th>2050</th><th>2100</th></tr>
<tr><td>~8.1 (-0.1 since the late 1870s)</td><td>7.935

(-0.165)

(using RCP 8.5)</td><td>7.77

(-0.33)

(using RCP 8.5)</td></tr>
</table>
</td></tr>
</table>

[87] Foley, M. M. and M. Carbines 2019. Climate change risk assessment for Auckland's marine and freshwater ecosystems. Auckland Council technical report, TR2019/015. Climate Change Risk Assessment series 2019.
[88] Statistics New Zealand. Sea-surface temperature: Data to 2023 https://www.stats.govt.nz/indicators/sea-surface-temperature-data-to-2023/.
[89] RCP refers to representative concentration pathway. RCP 8.5 is one of the greenhouse gas concentration pathways used by the Intergovernmental Panel on Climate Change reporting on global climate change projections. It outlines the highest pathway modelled by assuming the greenhouse gas concentrations continue to grow over the 21st century and that warming of 4 degrees Celsius or more occurs as a result.
[90] https://www.stats.govt.nz/indicators/coastal-sea-level-rise/.

Topic	State and impacts
Climate change	Another indicator of change in sea surface temperature is the amount of time a given area of the coastal marine environment spends in 'marine heatwave'. Marine heatwaves are prolonged events of abnormally warm water that can have significant impacts on marine ecosystems. The Western North Island coastal area spent approximately 88.5% of the year in marine heatwave in 2022. This was a large increase in time spent in marine heatwave in this area compared with all years over the preceding 40 years. For example, the annual average over the preceding 40 years was 12.6%. This was also the most time of any of the nine coastal regions around the country.[91] Extreme weather events are projected to become more frequent and higher in intensity – as experienced in the 27 January 2023 Auckland Anniversary Weekend floods and Cyclone Gabrielle on 12–14 February 2023. These storms resulted in large increases in sediment being mobilised on land and running into the harbour. In particular, steeper areas of the Waitākere Ranges and Āwhitu Peninsula recorded many landslips. Other coastal areas were also subject to extensive land slips, including the northern shoreline at Hillsborough. Identifying how these changes cumulatively impact marine ecosystems – which are already affected by a range of other pressures – is challenging.[10] Examples of the types of impacts that can be expected include: • warmer water can affect growth rates, species survival and distribution, invasive species incursion, and algal growth • increased acidity affects the condition, reproduction and survival of shellfish and plankton and nutrient processing • coastal habitats may be more frequently inundated by rising seas and may have limited ability to move as sea level rises where development is located at the coast • rainfall and storms may increase sediment and other contaminant run off when it rains. Manukau Harbour habitats are vulnerable to different climatic changes (see a full vulnerability assessment on page 8, Foley and Carbines 2019): • intertidal mudflats and rocky reefs are particularly vulnerable to changes in water temperature, extreme rainfall, and sea level rise • mangroves are vulnerable to sea level rise • seagrass is particularly vulnerable to water circulation changes • marine shellfish are particularly vulnerable to extreme rainfall and ocean acidification.

[91] https://www.stats.govt.nz/indicators/sea-surface-temperature-data-to-2023/.

Part 3: Response – stocktake of Auckland Council environmental management activities for the Manukau Harbour

This section summarises a stocktake of the council's current environmental management activity around the harbour. This analysis builds on stocktakes that were completed in 2020[92] and 2022.[93]

The stocktake addresses the 'response' category of the DPSIR assessment (see section 1.2 Our Approach). Response is defined as 'societal responses to mitigate negative impacts on the environment and halt or reverse environmental damage' in the DPSIR framework. For this analysis 'societal responses' were limited to Auckland Council responses. Thus, the objective of the stocktake is to identify Auckland Council environmental management activities focused directly on – or significantly contributing to – addressing identified pressures and impacts on the environmental health of the harbour.

3.1 Summary of Auckland Council activities

Stocktake information is summarised in Table 7. Limitations to the stocktake are outlined in section 1.2 Our Approach.

Table 7. Summary of Auckland Council environmental management activities for the Manukau Harbour.

Summary of Auckland Council environmental management activities for the Manukau Harbour		
Type of environmental management	**Specific projects/activities**	**Performance measures**
Governance	The **Policy and Planning Committee**[94] sets strategic direction, policies and plans with an environmental focus. Key initiatives are identified in this table. **The nine local boards** that border the harbour set direction and budgets for local parks and environmental and sustainability projects in their respective local board area. Local board budgets for environmental management are typically between $200,000–$400,000 annually; however, one local board allocated $1.5 million in the 2024–2034 Long-term Plan.	– Local boards include performance measures in the Long-term Plan, some examples are listed below for 'community action and education'.

[92] infocouncil.aucklandcouncil.govt.nz/Open/2020/11/ECC_20201112_AGN_9849_AT.PDF.
[93] Report Plans of Environment and Climate Change Committee - Thursday, 8 September 2022.
[94] Members are the Mayor, all Ward Councillors and two Houkura Independent Māori Statutory Board members.

Type of environmental management	Specific projects/activities	Performance measures
Co-governance and co-management	**Te Motu a Hiaroa** (Puketutu Island) is a 197 hectare volcanic island in the inner reaches of the Manukau Harbour. It is connected to the mainland by a 1.7 km causeway. The island is owned by Waikato-Tainui, Te Kawerau ā Maki, and Te Ahiwaru Waiohua. Watercare leases part of the island to deposit biosolids from the Māngere Wastewater Treatment Plant. A co-management trust oversees the distribution of funds from leases on the island. The island will be developed into public open space in the 2030s, once the biosolids infill is completed. **The Tūpuna Maunga Authority** governs the management of 14 tūpuna maunga across Tāmaki Makaurau, including five within the Manukau Harbour catchment: Te Pane o Mataoho / Māngere Mountain, Maungakiekie / One Tree Hill, Matukutūruru / Wiri Mountain, Ōtāhuhu / Mount Richmond, and Rarotonga / Mount Smart. **Te Pūkaki Tapu o Poutūkeka** is co-managed by Te Ākitai Waiohua and Auckland Council (Māngere–Ōtāhuhu Local Board).	Long-term Plan measures include #events considered by mana whenua, and the number of sites of significance protected or improved.
Advocacy	The **Manukau Harbour Forum** (MHF) was established in 2010. The MHF brings together one representative from each of the nine local boards that border the harbour to advocate for its environmental health. Each local board contributes funding to the Manukau Harbour Forum. The Forum collectively agree the use of this funding for initiatives such as: restoration planting, communications and education, Manukau Harbour Forum symposia, and employment of a Manukau Harbour Forum co-ordinator. The Manukau Harbour Forum oversees a budget of approximately $80,000–$100,000 annually. The Forum is a part of Auckland Council's governance structures, but does not have decision making authority, which sits with committees of the Mayor and ward councillors for regional decisions, and with individual local boards for local decisions.	
Strategy and policy	A suite of core strategies provide high-level and overarching direction for the environment and harbours: Auckland Plan 2050, Future Development Strategy, Infrastructure Strategy, Te Tāruke ā Tāwhiri, Indigenous Biodiversity Strategy, Auckland Water Strategy, Urban Ngahere Strategy. The council now has strategic direction specifically on the environmental health of the Manukau Harbour (adopted in June 2024). The open space, sport and recreation policy refresh and consolidation was adopted by the Policy and Planning Committee on 15 May 2025, along with the Southern Rural Strategy.	No Manukau Harbour specific performance measures identified. However, Manukau Harbour outcomes have now been adopted and objectives will be established over 2025/26 - through the Achieving Better Environmental Outcomes for the Manukau Harbour initiative.

Type of environmental management	Specific projects/activities	Performance measures
Regulate all activities through planning, consents and compliance	**Auckland Unitary Plan** sets out specific provisions for the harbour in the Regional Coastal Plan and establishes a level of protection for about half of the harbour as marine significant ecological areas (SEA-M1 and M2). Together the regional coastal plan provisions and marine SEAs seek to protect the coastline, and harbour biodiversity and water quality from adverse impacts due to land use and development. A review of the unitary plan is scheduled to start in 2026, although resource management reform will alter the review approach. There are **two tangata whenua management areas** in the harbour at Whatapaka Creek and Pukaki-Waokauri Creek. These were formalised in 1992 under the Māori Affairs Act. They provide for a higher level of protection of these areas from land use activities under the unitary plan, for example discharges directly to these areas. The unitary plan also protects identified sites of significance to mana whenua, which includes a number of coastal sites around the harbour. The unitary plan also sets provisions to manage the environmental impacts of land use and development across the catchment (regional and district plans). The application of these provisions through the consenting process aim to address the environmental impacts of land use and development on the health of the harbour (i.e. water quality and biodiversity). A **freshwater plan change** is being developed to implement the National Policy Statement for Freshwater Management 2020, although central government are reviewing how National Policy Statements will be used under resource management reform legislation. It considers freshwater impacts on the marine receiving environment and once implemented has the potential to significantly reduce land-based pressures on the harbour – particularly sediment and nutrient. **Section 35 effectiveness evaluation**: coastal waters[95] (complete) and subdivision, use and development in the coastal environment; natural character; outstanding natural landscapes; and biodiversity are all underway and evaluate the effectiveness of unitary plan provisions at protecting each topic listed. Findings of these evaluations will input into the review of the unitary plan, schedule to begin in 2026. Auckland Council issues **consents** and then manages **compliance monitoring and enforcement** for thousands of land use and resource consents as well as some permitted activities within the Manukau Harbour catchment. Proactive compliance programs are an important part of this activity. For example, the 'Close the Gap' initiative enabled compliance monitoring of sediment from small constructions sites. The result has been an increase in compliance with sediment and erosion control measures from 10% in 2019 to 80% in 2024.	No performance measures related specifically to harbour outcomes. The freshwater plan change will introduce target attribute states[96] and/or limits for freshwater (rivers and streams) considering the harbour but will not set specific targets for the harbour itself. Section 35 analysis uses indicators to assess the effectiveness of AUP provisions. Consents and compliance performance measures in the Long-term Plan do not include environmental outcomes.

[95] Auckland Unitary Plan Section 35 Monitoring B7.3 Freshwater systems and B7.4 Coastal Water, freshwater and geothermal water.
[96] For example, for suspended sediment in streams that flow into the Manukau Harbour.

Type of environmental management	Specific projects/activities	Performance measures
Waitākere Ranges Heritage Area Act implementation	Implementation of the Waitākere Ranges Heritage Area is meant to include protection of connections to and ecosystems at the coast of the Manukau Harbour. A long-term plan for the heritage area is to be developed. Working in partnership with mana whenua and mana whenua involvement in decision making for the heritage area are also planned.	Objectives are set out in the Act and reported on 5-yearly.
Māori outcomes	Mana whenua engagement through the 'Achieving better outcomes for the Manukau Harbour' initiative and Manukau Harbour Leaders Group proposal. Engagement and partnership on major projects – for example: co-governance and co-management arrangements (noted above); strategies, policies and plans; catchment-based programmes (noted below); Māori heritage, major infrastructure projects (e.g. Central Interceptor, 'Making space for water'). Three full-time equivalent kaitiaki have been employed by council and are working both for a mana whenua entity and the council to complete cultural assessments and stormwater inspections. $171 million in Māori Outcomes funding regionally over 2024–2034.[97] Projects supporting Māori Outcomes in the Manukau Harbour over 2023/24 included: • Te Kete Rukuruku – elevating Māori place names and stories in public spaces • three marae upgrades • Te Whakaoranga o te Puhinui – Puhinui stream restoration with Ngāti Tamaoho, Te Ākitai Waiohua, and Ngaati Te Ata Waiohua (catchment-based programme noted below). Watercare are developing a Māori supplier business network – Ngā Kakau Paraha. Watercare's goal is to have 5 per cent of total annual spend going to specialist Māori business partners by 2025.	Strategic direction for Māori Outcomes in Kia ora Tāmaki Makaurau – including partnership with mana whenua exercising tino rangatiratanga and kaitiakitanga. Departmental Māori Outcomes plans are under development.

[97] Auckland Council group Māori outcomes report 2023/2024.

Type of environmental management	Specific projects/activities	Performance measures
Environmental management by transport, storm water, water supply, wastewater, and community facilities for major capital projects and operations	Environmental management practises are applied across transport, three waters, and community facilities major capital projects and operations. This is almost exclusively achieved through consenting and compliance requirements. However, environmental sustainability goals over and above resource consent compliance have been adopted by Auckland Transport – Auckland Transport Sustainability Strategy and Watercare is developing innovative technology and upgrades to improve the Māngere Wastewater Treatment Plant performance. Examples of environmental risk management of major, large-scale day-to-day operations: • wastewater treatment plant discharges managed for consent compliance – to manage environmental effects • dams managed to provide environmental flows downstream • water supply catchments managed for conservation outcomes that contribute to the health of the harbour • stormwater upgrades that seek to rehabilitate streams for ecological outcomes, manage flooding and treat water quality • stormwater monitoring to identify pollution and eliminate at source (i.e. 'Safe Networks' programme noted below) • stormwater maintenance, for example cleaning catchpits. Major investments over the 2024–2034 Long-term Plan include road renewals, the Eastern busway, the city rail link, water and wastewater network renewals, Central Interceptor, Huia water treatment plant, Redoubt Road reservoir expansion, south-west (Clarks Beach and Waiuku) wastewater treatment plan upgrade, Waiuku water supply, Puketutu biosolids, and the Paerata Culvert flood protection works.	Nearly all Long-term Plan environment performance measures focus on achieving consent compliance. Healthy Waters and Flood Resilience have newly added **low faecal contamination at beaches** as a Long-term Plan performance measure. The stormwater network discharge consent includes a suite of objectives and outcomes that must be achieved, including healthy and connected waterways that provide for te mauri o te wai. Auckland Transport has specific, timebound environmental targets in its sustainability strategy – e.g. **30% stormwater runoff from busiest roads treated by 2030**.
Management of (Auckland Council owned) closed landfills	Environmental risk management to achieve consent compliance – this includes a comprehensive environmental monitoring programme. Environmental risks are identified and addressed for each site under management by the council.	Consent compliance.

Type of environmental management	Specific projects/activities	Performance measures
Management of coastal land and assets	Much of the coastal edge of the Manukau Harbour is public open space and managed by Auckland Council – this includes three regional parks, and many local parks, esplanade reserves, cemeteries, and many built assets (e.g. boat ramps, sea walls, roads, buildings, structures, etc.). Local parks omnibus management plans by local boards; and local board walkways and trail programmes. Shoreline adaptation plans (listed above) direct how Auckland Council's coastal assets will be managed in response to sea level rise and coastal hazards over the coming decades. A 'blue-green network spatial tool' is being developed that will support prioritisation of coastal management for harbour outcomes.	No performance measures related to environmental outcomes/Manukau Harbour outcomes.
Catchment-based programmes	The **Puhinui regeneration** and **Onehunga regeneration** are urban regeneration programmes that have taken an integrated catchment-based approach and have set improving water quality in the Manukau Harbour as an outcome. They seek to achieve this through taking a water sensitive design approach and making improvements to, for example, stormwater quality, indigenous biodiversity, canopy cover (shade), and community empowerment. Both initiatives have partnered with mana whenua. The Onehunga programme includes a proposal for an education centre and coastal restoration at Onehunga wharf. The **Pukekohe Integrated Catchment Management Plan** is a collaboration focused on reducing nutrient leaching from the Pukekohe area into local groundwater, streams and the Manukau harbour. The collaboration is between Ministry for the Environment, mana whenua, horticultural growers, HortNZ, Waikato Regional Council, and Auckland Council.	Mauri assessment framework being applied in these programmes, working with mana whenua.

Type of environmental management	Specific projects/activities	Performance measures
Water quality management	**Strategic approach to sediment programme** – including the 'Close the Gap' initiative to reduce sediment in streams and harbours by improving sediment controls' compliance at development sites. **Unsealed roads improvements programme** to reduce sediment by improving unsealed roads to better manage runoff as one outcome. **Safe Septic:** guidance to support and educate landowners regarding onsite wastewater treatment requirements, which are then checked as part of the Safe Septic onsite wastewater unit compliance monitoring programme. **Safe Networks:** monitoring and addressing contaminants in the stormwater network and streams. **Contaminant reduction initiatives:** reducing litter, sediment and road pollutants entering waterways (including the harbour). For example, the **industrial trade activity proactive programme** aims to increase consent compliance of industrial and trade activity sites. Since 2014, 2508 site visits have been made within the stormwater catchments that drain to the Manukau Harbour. These site visits have resulted in 830 site reports being completed that identify major and minor potential and actual pollution issues on the site. As a result, 691 pollution issues (actual or potential) have been resolved. The Manukau central area in the Puhinui catchment has been a focus. 225 sites have been visited and compliance has been improved from 10 per cent to 36 per cent from the first to second visit. **Urban and rural stream rehabilitation** (including wetland restoration). Hillguard and a partnership with Fonterra are two examples. • **HillGuard:** funds 100 per cent of erosion control on steep, high erosion risk, pastoral, private land through native afforestation or spaced planting. In FY24/25, Manukau Harbour projects have received $15,000 for six property's Erosion Control Plans. In FY25/26, Manukau Harbour projects are allocated $286,000 for seven erosion control projects to plant over 44,000 native plants and install 3 km of fencing. Once the project is complete, 15 ha of high erosion risk land will be protected through native afforestation. The total funding allocation is over $600,000, including $150,000 via the Ministry for Primary Industries. Te Korowai o Papatūānuku is contributing 12,000 plants. • **Fonterra & Auckland Council partnership for 'wet area' restoration:** is restoring grazed wet areas on dairy farms to wetlands through fencing and indigenous planting. About $544,000 in funding is going to wetland restoration in the Manukau Harbour catchment. This will enable 7.4 hectares of wetland to be restored with 71,500 plants over financial years 24/25 and 25/26. **Southern catchments alignment project** (in early planning stage) will reduce contaminants from roads entering the Manukau Harbour.	Performance measures for these programmes is not visible in readily available reporting. Output reporting is provided at a regional scale.

Type of environmental management	Specific projects/activities	Performance measures
Biodiversity and biosecurity management	**Biodiversity Focus Areas** represent the *minimum sites requiring targeted management to ensure protection of indigenous ecosystems and threatened species* as outlined in the Auckland Council Indigenous Biodiversity Strategy 2012. There are eight distinct biodiversity focus areas on the harbour's edge containing a range of ecosystem types, with many more in the wider harbour catchment. These sites are important remnants of the Manukau Harbour foreshore and coastal ecosystems. Biodiversity Focus Areas guide and prioritise investment in biodiversity management activities. **Shell barrier management** – i.e. targeted mangrove management to protect wading bird feeding and roosting sites. **Ecological restoration**/planting efforts (collated planting across the council group): approximately 600,000 plants planted in the Manukau Harbour catchment over 2021–2024. One example is **Te Korowai o Papatuānuku**, a project involving the restoration of culturally and ecologically significant sites to Ngāti Te Ata Waiohua on Āwhitu Peninsula. Existing plantings across three sites will be maintained to ensure a high rate of survival – Waipipi, Reretēwhioi Marae, and Tāhuna Pā. A further 15,000 plants will be planted across these three sites with volunteers from Ngāti Te Ata, Reretēwhioi Marae, Āwhitu Landcare, local schools, and corporate groups. Auckland Council published Te Haumanu Taiao in 2023 – guidance on terrestrial, wetland and riparian ecosystem restoration. **Terrestrial biosecurity management** involves a range of ongoing activities such as pest plant and pest animal control, habitat improvement through planting and physical protection of vulnerable animals such as nesting shorebirds. They are also the subject of on-going monitoring. Auckland Council are surveying and controlling *Spartina* at 23 locations around the Manukau Harbour from Penrose to Matakawau near the top of the Āwhitu Peninsula. Several of these locations are monitored (using aerial surveillance) to ensure that nothing is present. **Marine biosecurity** – a regional marine biosecurity programme is in place to prevent the spread of marine pests within, to and from the harbour. This includes management through the Regional Pest Management Plan, the Top of the North inter-regional partnership, direct boat hull surveillance (on the east coast), education/awareness raising, and research. The Regional Pest Management Plan identifies marine pest species and management response, and introduced a rule requiring all crafts entering any marine water body to be free from ballast, bilge or holding tank water, etc. Direct boat hull surveillance is carried out on 1200 east coast boats a year. This benefits Manukau Harbour; however, lower boat use and poor visibility mean that hull surveillance is not carried out in the harbour. **Freshwater biosecurity** – is focused on preventing new freshwater invasive species establishing in the region, mainly through education campaigns such as the 'check, clean, dry' campaign, which encourages freshwater users to clean their gear between waterways. Surveillance for freshwater gold clam is also underway.	Performance measures for these programmes is not visible in readily available reporting.

Type of environmental management	Specific projects/activities	Performance measures
Biodiversity and biosecurity management	**Managing and preparing for pathogens – Auckland Council:** • provides information about botulism to reduce its occurrence and removes dead birds to reduce its spread • has response preparedness work in place for High Pathogenicity Avian Influenza • has limited management in place to limit the spread of toxoplasmosis from cats to the marine environment.	
Internal analysis, reporting and decision support tools	'**Freshwater Management Tool**': stormwater contaminant reduction model. '**Ruru**': conservation data collection and analysis tool.	Performance measures for these programmes is not visible in readily available reporting
Litter	Collection of dumped rubbish from around the harbour. Fund the work of Sea Cleaners, a charity organisation that removes rubbish from the waters of the harbour.	
Climate action	Implementation of Te Tāruke ā Tāwhiri – emissions reduction goals and investment across the council group. The plan also addresses the effects of climate change on our coastline and has led to the preparation of shoreline adaptation plans (SAPs). Āwhitu, Manukau Harbour South, Pahurehure Inlet, and Manukau Harbour East shoreline adaptation plans (SAPs) have been published. Manukau Harbour North is still to be finalised and published at the time of writing. Shoreline adaptation plans identify the long-term management approach for Auckland Council assets at the coast as climate and coastal hazards change. Adaptation and resilience programmes across the council group (e.g. Resilient Tāmaki Makaurau). Climate change risk assessment conducted in 2018 to contribute to the development of Te Tāruke ā Tāwhiri, (including a marine environments risk assessment).	
Community action and education	Community education and support for community groups and community led projects is delivered by departments across the organisation and through local board plans. The nine local boards that border the harbour fund projects for stream restoration, water quality monitoring, pest management, water efficiency, climate action, and support for community restoration groups. Collectively those nine local boards fund the **Rangatahi Environment Actions Leaders** (REAL) programme through the Manukau Harbour Forum. **The waterways protection fund** distributed over $690,000 in the Manukau Harbour catchment over financial years 22/23, 23/24, and 24/25. This supported 44 projects that included planting 150,000 plants in 43 hectares of riparian margin and 16 kilometres of fencing to protect over 17 kilometres of stream. In-kind contributions for landowners brings the total value of these projects to $1.5 million. Public engagement and communication tools: **Safeswim** and **Tiaki Tāmaki Makaurau**.	No Manukau Harbour related performance measures identified. **Local Board performance measure examples:** #community groups supported #planting events #pest management events

Type of environmental management	Specific projects/activities	Performance measures
Research, monitoring, evaluation	Long-term regional state of environmental monitoring of benthic ecology, coastal sediment contamination, and coastal water quality. Recent research projects include: • Conservation status of birds in Tāmaki Makaurau analysis and publication • a study on pharmaceuticals contamination in the harbour (results due soon) • a study to identify and monitor shag colonies around the harbour • collaboration with Auckland University on a study into the effects of artificial light at night (ALAN) on seabirds in the harbour • a partnership with Birds NZ to continue monitoring wading bird numbers in the harbour • targeted marine pest survey 2019.	% state of environment monitoring completed (new measure, target to be set).

3.2 Stocktake insights

Auckland Council Group delivers on a broad suite of environmental management responsibilities and activities, that can be categorised into the following main types of activity:

- regulatory environmental planning, consents and compliance
- water quality protection and improvement initiatives
- biodiversity and biosecurity protection and improvement initiatives
- climate response (i.e. emissions reduction and adaptation)
- parks and other public open space management
- infrastructure environmental risk management
- environmental research, monitoring and reporting, and evaluation.

Across all these types of activity there is evidence of mana whenua engagement, partnership, as well as mana whenua-led initiatives that are supported by Auckland Council.

The council also seeks to support community engagement, action and education, and community-led initiatives where relevant across these activities.

Environmental management efforts across the council group (and predecessor organisations), particularly improvements over the last four decades, mean that the harbour is in a better state than if these efforts were not in place. For example, water quality in the harbour is better today than it was 30 years ago. It is also important to recognise that efforts to reduce pressures on the harbour today may not have measurable effects for several years and improvements to life in the harbour could take decades to eventuate.

Protecting and improving the health of the region's coastal marine environment is clearly articulated in a few high-level strategic documents (e.g. Auckland Plan, Auckland Water Strategy, Te Tāruke ā Tāwhiri) [98] and the Auckland Unitary Plan. A suite of operational programmes have been established – over several years – that seek to implement this strategic direction and directly address the following pressures (as outlined in Section 2.2) on the Manukau Harbour:

- Loss of natural systems: biodiversity focus areas management, pest plant and pest animal management, and restoration/replanting initiatives that have resulted in planting 600,000 plants in the harbour catchment over the period 2021-2024.
- Nutrient from rural and urban activities: unitary plan provisions, consenting and compliance to limit nutrients from land-based activities and wastewater discharges and overflows.
- Sediment from rural and urban activities: unitary plan provisions, consenting and compliance as well as continual improvement initiatives such as the 'Strategic approach to sediment' programme and the 'Close the gap' project; and initiatives to support private landowners to plant erosion prone land in rural areas (e.g. 'Hill Guard' programme).
- Emerging contaminants: early research into pharmaceuticals in the harbour, for which results are not yet available.
- Artificial lights at night (ALAN): involvement in university-based research on ALAN underway now, for which results are not yet available.

[98] High-level strategic direction for the Manukau Harbour has recently been adopted by the council; however, specific objectives to deliver on this strategic direction and an implementation programme are still to be established. Thus, evidence of implementation of this strategic direction is not yet able to be assessed across the council's activities.

- Infrastructure construction and operation: consent compliance; stormwater discharge monitoring; Auckland Transport sustainability strategy.
- Industrial pollution: unitary plan provisions and the industrial pollution prevention programme to support industrial organisations to improve their performance.
- Invasive species and organisms: non-marine pest management, marine-pest investigations, marine biosecurity education and proactive management.
- Protection of coastal habitat: unitary plan provisions, consenting and compliance to limit development and coastal modification.
- Faecal contamination: 'Safe Networks', and 'Safe Septic' programme, and 'Safeswim', which delivers improved communication of risks to the public.
- Invasive pests and organisms: several marine biosecurity initiatives – avian influenza preparedness, avian botulism management activities to limit spread, marine pests research, terrestrial pest management (plant and animal).
- Marine litter: collection of dumped rubbish (relies on reporting by the public) and funding for 'Sea Cleaners' a not-for-profit organisation that collects and disposes of rubbish in the harbour.
- Individual behaviour: a suite of community education and action activities.
- Climate change: emission reduction commitments, climate risk assessment and shoreline adaptation plans.

Marine environment *focused* activities were more limited than terrestrial, catchment focused activities across the council group. Examples of Manukau Harbour marine environment focused activities include:

- the Achieving better environmental outcomes for the Manukau Harbour initiative to develop strategic direction, support implementation and evaluate progress over time
- Manukau Harbour Forum – local boards advocacy group
- The Regional Coastal Plan and marine significant ecological areas in the Auckland Unitary Plan
- processing of new consent applications for activities in the harbour
- compliance monitoring of several major consents that discharge directly into the harbour
- stormwater monitoring to identify and limit pollution events
- marine biosecurity research and avian disease response
- some wading bird habitat management for pests, etc.
- seabird research (two studies underway)
- harbour state of environment monitoring.

The following challenges were identified:

- Manukau Harbour habitats and species are rarely a focus of Auckland Council activities.[99]
- Trade-offs between activities – when one is supported another may not be – are not necessarily clear to decision makers.
- Some pressures are not being addressed, or not enough is known about them to identify management options. Gaps are discussed in the next section.
- The council's regulatory functions – planning, consenting and compliance – are the most impactful environmental management levers for the harbour available to the organisation. These functions require adequate resourcing and an assessment of needs to support improvements in achieving harbour outcomes.

Further, it's not clear we are adequately prepared for several future risks:

[99] Implementation of strategic direction for the Manukau Harbour is expected to address this.

- Is the council's environment management system set up to avoid the negative impacts related to the scale of growth expected around the catchment over the next few decades?
- Is there adequate environmental risk management in place for the council's committed investment as outlined in the Long-term plan, the majority of which is infrastructure investment to maintain existing assets or construct the infrastructure required to support growth.
- Is the council making decisions around the coast having considered climate impacts on marine species and habitats?
- Are we prepared to manage marine biosecurity incursions and disease outbreaks in the Manukau Harbour? (noting that preparations for these circumstances have been made that would be able to be applied to relevant coastal areas – this question seeks to identify is there more the council needs to do).

Some of the challenges for assessing this environmental management regime across the organisation include:

- many initiatives do not have transparent performance measures against which impact can be assessed; further, these are not aggregated (where relevant) to a catchment scale to assess the overall impact of projects towards catchment scale goals or targets
- the degree to which any one of these initiatives is addressing the pressures they target is not possible to identify (most likely due to limited application of performance measures)
- some initiatives are small in scale compared to the pressure they target – this may be because they are in the early stages of development and may be testing approaches and developing proof of concept prior to scaling; because the scale of the pressure is not well quantified; or because they require more resourcing to achieve more.
- environmental management activities are highly disaggregated across the council group; and many small-scale projects and activities have been established across the group.

3.3 Identification of gaps

One of the objectives of identifying and assessing drivers, pressures, state, impacts and response information was to enable the identification of gaps in the council's environmental management for the health of the Manukau Harbour. These 'gaps' can similarly be considered opportunities.

Information in the preceding sections of this document – about pressures, state and impacts and council environmental management activities – have been reviewed to identify at a high level:

- where environmental management activity may not be fully addressing the pressure/s targeted
- where a known pressure may not yet have management activity in place
- knowledge gaps in relation to a pressure or environmental state and impacts
- any gaps or opportunities to further support kaitiakitanga and people taking care of the harbour
- other general, overarching gaps observed through this process of collating and assessing information about the council's activities and the health of the harbour.

This assessment is based upon the assumption that addressing identified pressures on the harbour will progress achievement of the harbour's environmental outcomes as set out in strategic direction for the health of the Manukau Harbour. The environmental outcomes are:

(1) The waters of the harbour support healthy, thriving and diverse ecosystems. They are safe to swim in and collect kai (food) from.
(2) The ecosystems, habitats and species of the harbour are thriving and plentiful.

(3) Life in and around the harbour adapts and thrives in a changing climate.

Environmental outcomes (4) to support kaitiakitanga by mana whenua and (5) to support Aucklanders to take care of the harbour are addressed separately because achieving these outcomes does not rely as heavily on addressing pressures on the harbour.

Identified gaps are set out in a series of tables below. Table 8 identifies:

- environmental pressure (left column)
- the gaps or opportunities identified by staff (centre column)
- the Manukau Harbour outcome/s (one–five) that would be supported by addressing the pressure listed (right column).

Table 8. Opportunities to address gaps in the environmental management of pressures on the health of the Manukau Harbour.

Opportunities to address gaps in the management of a pressure that is impacting the health of the harbour		
Pressure	**Gaps/opportunities identified**	**Reducing this pressure contributes to these outcomes**
Loss of terrestrial and marine ecosystems/habitat	The council has a suite of activity across its departments and CCOs that contribute to restoring and protecting natural systems. This is particularly focused on terrestrial systems. There are opportunities to: (1) introduce catchment-based goals for: • Increasing marine habitats and wetlands • Increasing indigenous vegetation in rural catchments (2) co-ordinate, collaborate and assess impact (3) develop new and grow existing activities. There is an opportunity to introduce more deliberate marine habitat activity. More resourcing and/or support systems to enable existing work to increase marine habitat, wetlands, indigenous vegetation in rural catchments to scale up.	Outcome 1: Water quality Outcome 2: Biodiversity Outcome 3: Climate resilience
Sediment	The council's activities to reduce sediment entering the harbour are not yet fully addressing this pressure. There are opportunities to: (1) introduce an objective to reduce sediment in the inlets of the harbour (where they are elevated) and maintain lower sediment levels where they are low (i.e. protect where the state of the harbour is good). (2) assess sources of sediment and options for addressing sediment from those sources (if this analysis is not already complete) (3) establish management response – for example, review of unitary plan provisions, scale sediment reduction programmes consistent with Strategic Approach to Sediment Programme and assess options for addressing legacy sediment build-up.	Outcome 1: Water quality Outcome 2: Biodiversity

Pressure	Gaps/opportunities identified	Reducing this pressure contributes to these outcomes
Nutrients	The council's activities to reduce nutrients entering the harbour are not fully addressing this pressure. There are opportunities to: (1) introduce an objective to reduce nutrient concentrations in the waters of the harbour where they are highest (in around the harbour's inlets) (2) assess the source of nutrients and options for addressing nutrients from those sources (if this analysis is not already completed) (3) establish management responses – for example, review of unitary plan provisions, research on discharges to the harbour (that are not monitored) and the effectiveness of discharge consent conditions (for example), working with Watercare on options to reduce nutrients discharged from the wastewater treatment plants around the harbour.	Outcome 1: Water Quality Outcome 2: Biodiversity Outcome 3: Climate resilience
Pressures on wading and seabirds	The council has a suite of activities that provide protection for wading and seabirds that visit the harbour. The protection provided to seabirds is sometimes a co-benefit of the activity and not necessarily the primary outcome sought. There is an opportunity to more clearly identify the approach and activity that council will undertake to ensure wading and seabirds are protected while visiting the harbour. This would include: • ensuring that unitary plan provisions to protect wading bird habitats are being effective • identifying where animal pest and plant pest management activity is needed and confirming that adequate pest management is in place and/or increasing the level of pest management in place at appropriate locations • assessing the issues and options for the council to address the risks that light and noise, particularly lights at night, pose to wading and seabirds • assessing the issues and options for the council to address the risks posed to wading and seabirds by plastics, disease and any other threats • assessing the need to better support community organisations that look after indigenous birds and their habitat.	Outcome 2: Biodiversity Outcome 3: Climate resilience
Pathogens	The council has a role in addressing the risk of toxoplasmosis to Māui dolphins. Cats are identified in the Regional Pest Management Plan and feral cats are included in rural animal pest management projects where possible – mostly to achieve terrestrial species outcomes. There is opportunity to: • develop a more comprehensive management plan for toxoplasmosis, including updating the Regional Pest Management Plan to better target toxoplasmosis • establish an objective for toxoplasmosis management • assess the threat of toxoplasmosis and the effectiveness of the council's management activity over time.	Outcome 1: Water quality Outcome 2: Biodiversity Outcome 3: Climate resilience

Pressure	Gaps/opportunities identified	Reducing this pressure contributes to these outcomes
Marine litter and microplastics	The council does not actively manage marine litter or microplastics. There is an opportunity to: • assess the issues and options for the council to address marine litter and microplastics issues affecting the Manukau Harbour • establish an objective for both marine litter and microplastics management.	Outcome 1: Water quality Outcome 2: Biodiversity
Climate change	The council is in the early stages of developing its approaches to considering the impacts of climate change on ecosystems and species and how the council's decisions and management approaches may affect adaptation of ecosystems and species to changes occurring. There is an opportunity to: • establish an objective related to considering the impacts of climate change on marine ecosystems and species into decisions • assessing the risks to marine ecosystems and species of hard infrastructure at the coast as climate changes • establish management response.	Outcome 3: Climate resilience

Strategic direction for the Manukau Harbour identifies the outcomes of supporting kaitiakitanga by mana whenua and people taking care of the harbour (outcomes four and five). Several identified gaps in Auckland Council's activities for the harbour, that if addressed, would contribute to the achievement of outcomes four and five. These are described in Table 9.

Table 9. Opportunities to progress Outcome 4 and Outcome 5 of the strategic direction for the Manukau Harbour.

Opportunities to address gaps in the council's activities to progress outcome 4 and outcome 5 of the strategic direction for the Manukau Harbour	
Outcome	**Gaps identified**
Outcome 4: Supporting kaitiakitanga	Currently, there are limited opportunities for the Governing Body, local boards, and mana whenua to work together on Manukau Harbour outcomes and improvements (a proposed meeting of iwi and council leaders is seeking to address this). No ***marine focused*** initiatives/partnerships or funding to support kaitiakitanga for Manukau Harbour identified through the stocktake process. Further, at times decisions by the council may may have an effect on the exercise of kaitiakitanga for the harbour by mana whenua that the council could better recognise and/or address.
Outcome 5: People take care of the harbour	**Public open space:** Management of coastal public open space is not considered or managed in a joined-up way that considers the harbour and potential for harbour outcomes through more coordinated management (note that the open space, sport and recreation policy refresh will go partially address this). Access to public open space in the rural south of the harbour catchment is limited. Noting that the need for public open space in the south as growth occurs has recently been recognised by the council. Harbour-wide approach, objectives and related activities to harbour access and facilities. Harbour-wide, harbour focused approach to supporting community organisations working for the health of the harbour. Limited focus on education for the harbour/marine health outcomes.

Outcome	Gaps identified
Outcome 5: People take care of the harbour	Limited focus on supporting community action with a harbour/marine health focus. Limited education about how people's individual behaviour impacts on the harbour. Objectives to achieve and track progress towards improving people's caretaking behaviour towards the harbour. Management response to limit recreation activities' impacts on marine species and habitats.

Gaps in knowledge about a pressure or issue affecting the environmental health of the harbour and gaps in knowledge about an Auckland Council activity are described in Table 10.

Table 10. Gaps in knowledge about a pressure or issue affecting the health of the Manukau Harbour and gaps in knowledge about an Auckland Council activity that relates to Manukau Harbour outcomes.

Gaps in knowledge	
Topic area	**Gap identified**
Mana whenua knowledge for the harbour	Mana whenua knowledge is not a part of 'readily available, existing publications' used to identify drivers, pressures, state and impacts in this analysis. Mana whenua expertise about the state and changes to the harbour's environment would benefit any Auckland Council assessment of state and impacts.
Habitat	• Evaluation of the effectiveness of existing unitary plan provisions to protect biodiversity, habitats and species of the harbour. • Habitat extent and change in extent (Manukau Harbour habitat mapping planned to be completed in 2025/26). • Habitat quality and change in quality.
Species	• Relative abundance of finfish, shellfish, and marine mammals and trends in their populations. • Light and noise impacts on wading and seabird species and other species; options to address light and noise pressures. • Freshwater invasive species presence, abundance, and impacts information.
Sediment	• Better understanding of urban sediment volumes and sources. • Harbour sediment accumulation rates. • How sediment is moving around the harbour.
Coastal modification	• Effectiveness of unitary plan provisions to limit coastal modification (section 35 effectiveness review underway now that will provide this information). • Coastal modification – total area modified, change in area modified.
Recreation	Identification of recreational activities that impact upon habitat and species of the harbour, including: • the scale of the issue • impacts on habitat and species • management response options.
Contaminated sites	Research to identify the environmental impacts of contaminated sites on water quality and biodiversity in the harbour, and management options.
Marine litter and microplastics	• Marine litter extent, volumes, sources and management options. • Microplastics extent, volumes, sources and management options.
Unknown pressures	There may be pressures impacting the health of the harbour that have not yet been identified.

Part 4: Priority focus areas for setting objectives to achieve Manukau Harbour environmental health outcomes

4.1 Priority focus areas for setting objectives

The purpose of completing a DPSIR and gap assessment is to underpin the identification of priorities for achieving better environmental outcomes for the Manukau Harbour – both in terms of the biophysical outcomes we are seeking to achieve, as well as organisational objectives that may be established.

This section identifies priorities for achieving better environmental outcomes for the Manukau Harbour that will underpin the next stage of work – Stage 3 – to identify SMART objectives to achieve five outcomes for the harbour.

The following priority focus areas for setting SMART objectives have been identified:

- loss of terrestrial ecosystems, which has resulted in increased sediment generation across the catchment, reduced filtration of sediment and other contaminants before they reach the harbour as well as the loss of or change to a suite of ecosystem functions and processes that supported life in the harbour
- loss of coastal and marine[100] ecosystems, which has resulted in reduced habitat for species to shelter in and feed from as well as a suite of other ecosystem functions and processes
- sediment in the water column and sediment accumulation in and around the harbour's inlets, which has resulted in lower diversity of benthic species – reducing ecosystem resilience and food availability for fish and bird species
- nutrients in and around the harbour's inlets, which can reduce the life supporting capacity of the waters of the harbour; however, this impact is being limited in the harbour by the high levels of sediment observed at the same locations
- a suite of pressures on wading birds and seabirds of the harbour – including pest plant and pest animals, people's recreational activities, pathogens (e.g. botulism), artificial lights at night, as well sediment (noted above) smothering food sources
- toxoplasmosis, which is estimated to kill ~2 Māui dolphins annually along the west coast of the North Island. There are approximately 54 Māui dolphins. They live exclusively along the west coast of the North Island; in the same area that toxoplasmosis concentrations are estimated to be highest in the marine environment across Aotearoa New Zealand.

The following high risk potential future pressures are also included as priority focus areas for setting SMART objectives:

- urban intensification and growth around the catchment

[100] Loss of seagrass in the 1960s is attributed to a disease that does not originate from the land or people's activities.

- climate change impacts on marine ecosystems, including increasing temperature, sea level rise and higher ocean acidity
- marine invasive species entering the harbour
- High Pathogenicity Avian Influenza reaching Aotearoa New Zealand and affecting birds of the harbour.

Setting objectives to progress towards Outcome 4 to support kaitiakitanga for the harbour by mana whenua will focus on:

- establishing a periodic meeting between mana whenua leaders and Auckland Council elected members
- providing direct support to mana whenua
- access to the harbour
- partnerships for improving the health of the harbour.

Setting objectives to progress towards Outcome 5 to support Aucklanders to take care of the harbour will focus on:

- public open space management around the harbour's coast, and harbour access
- harbour focused community action and education and support for community organisations
- littering and illegal dumping.

These priority focus areas for objective setting will underpin the next stage of this initiative. Setting objectives will require adequate information being available to establish specific and measurable goals.

The expectation is that knowledge gaps (identified in the previous section) will be considered and addressed wherever possible as part of the work to set (or achieve) objectives to address these priority focus areas.

The process to set objectives will focus on engagement with relevant staff, mana whenua, and elected members. Engagement will include reviewing these priorities and identifying the information needs for objective setting and needs and opportunities to implement proposed objectives.

How objectives will be implemented will be identified as a part of Stage 3. The expectation is that all levers at the council's disposal will be required to implement actions in line with agreed objectives.

ISBN 978-1-991377-03-6 (PDF)

Auckland Council disclaims any liability whatsoever in connection with any action taken in reliance of this document for any error, deficiency, flaw or omission contained in it.

© 2025 Auckland Council, New Zealand

Find out more: research@aucklandcouncil.govt.nz
or visit knowledgeauckland.org.nz and aucklandcouncil.govt.nz

Te Kaunihera o Tāmaki Makaurau
Auckland Council