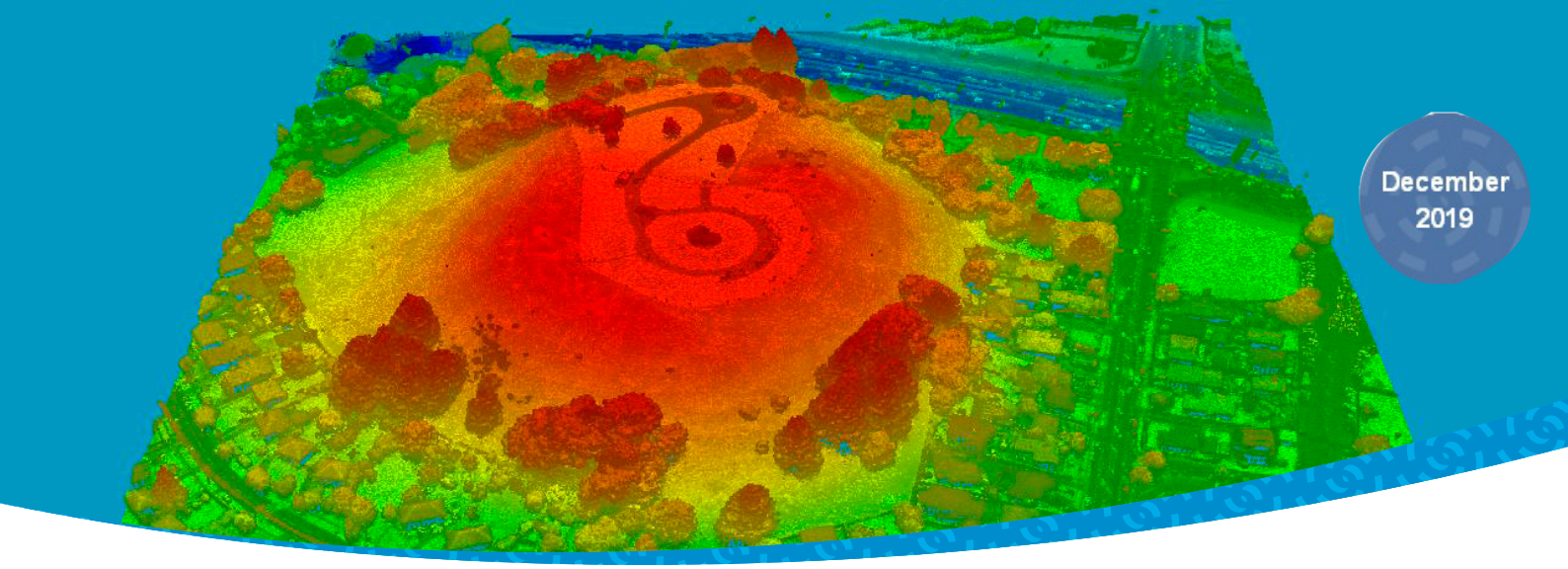


December 2019

Monitoring Research Quarterly

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Contents

Monitoring Research Quarterly is the newsletter of Auckland Council's Research and Evaluation Unit, RIMU. This is a double issue for September and December 2019.

RIMU publications are available on council's research information website, Knowledge Auckland

www.knowledgeauckland.org.nz

RIMU Research and Evaluation Unit

Auckland's urban forests

Creating forest cover information from LiDAR point cloud data

The structure and function of Auckland's forests is important to the region for the ecosystem services they provide, including their inherent value. Out of this recognition has grown a keen interest in understanding the status of tree cover throughout the region (in particular, in developed urban areas) on the part of numerous groups and individuals, including Auckland Council itself, elected members, and the general public.

An initial study was conducted on the urban forest of Waitematā Local Board, based on data collected in 2013 (*The urban forest of Waitematā Local Board in 2013*, Bishop and Lawrence 2017). This was followed by a study of tree loss in Waitematā Local Board between 2006 and 2016 (*Tree loss in the Waitematā Local Board over 10 years, 2006-2016,* Lawrence et al. 2018). In March 2019, Auckland Council published Auckland's *Urban Ngahere (Forest) Strategy*, which includes among its 18 actions one to monitor the status and change of Auckland's tree canopy cover[1]. The need to understand Auckland's tree canopy cover extends to other programmes as well, including ecological corridor modelling (council's Biodiversity and Biosecurity teams) and Auckland's greenhouse gas inventory (RIMU).

This urban forest status and trends project addresses these needs by constructing and analysing tree canopy cover from data collected between 2016 and 2018, in order to provide both an assessment for this time period, as well as conduct a change detection for nominal three-year period (comparing to a 2013 tree canopy cover).

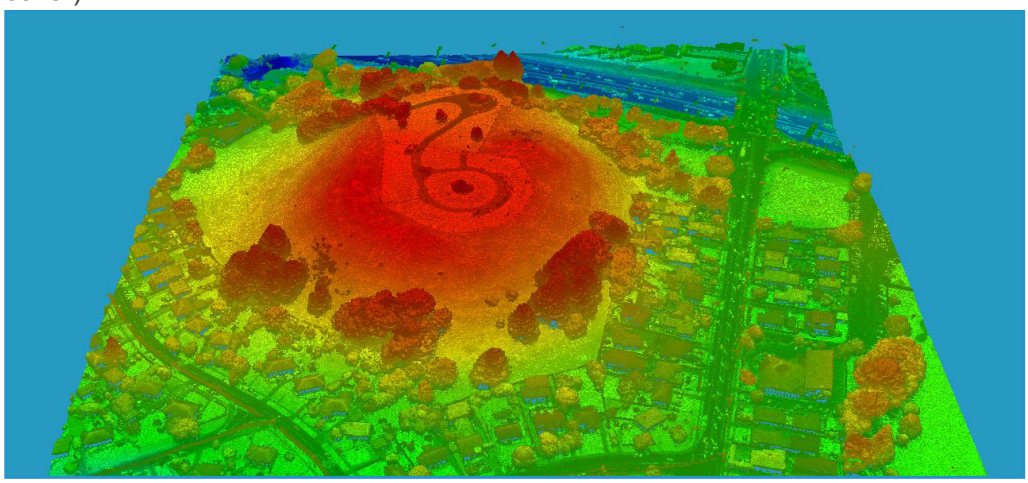


Figure 1: LiDAR point cloud (colour coded by height)

1. "Incorporate three-yearly LiDAR surveys in council work programmes."

This will provide both a baseline for status of tree cover at the time the Auckland Unitary Plan came into effect (operative in part as at November 2016) and an opportunity to evaluate the effect of changes to tree protection rules and policies, which came into force in 2013. As such, this project provides pertinent data that will form important information to a broader programme of work on Auckland's forests, which will seek to build better understanding of composition, structure, and function of Auckland's varied forests.

This 2013-2016/18 project was predicated on the availability of the most recent LiDAR data acquisition (collected between 2016 and 2018). Thus, for this project, the 2016/18 LiDAR is used as the main data set to construct tree canopy cover information. While much mention of LiDAR has been made in relation to understanding changes to Auckland's tree cover, it is important to note that LiDAR data themselves do not provide this information; rather they are just remotely sensed data, akin to a collection of field data recorded by data loggers or field teams.

LiDAR stands for Light Detection and Ranging: the instrument is an active LASER scanner in the near infra-red part of the spectrum, and it sends out up to 400,000 pulses per second from a sensor. The sensor is mounted on an airplane and flown over the area of interest (in this case, the Auckland region). Distance from the sensor to an object on the ground is translated from the time it takes for the pulse to return to the sensor. A GPS unit on board the plane tracks the location of the sensor during the entire flight, from which the geographical position (x, y) and height (z) coordinates are assigned to each pulse. The result is a point cloud (Figure 1, page 1), which provides a visual representation of the Earth's surface, including ground, buildings, trees, grass, and water bodies. After collection, every point in the point cloud is classified accordingly, using the standard LiDAR point schema developed by the American Society for Photogrammetry and Remote Sensing (ASPRS, Figure 2).

The classified point cloud remains just a data set. The next step is to create *information*, in this case – tree canopy cover and canopy height models (Figure 3). (Note, other information of interest can also be derived from the data, including digital elevation models and building outlines).

This "post-production phase" is an intensive process in terms of both time and computing resources. The 2016-18 data set consists of turning that into tree cover takes many hours of computing time and terabytes of storage space. The processing of these canopy models for the change detection has been completed (to be followed, in due course, by the rest of the region). The analysis of the state of Auckland's 2016/18 forests, and changes since 2013 is underway; a report is expected to be released in early 2020. Stay tuned!

Figure 2: classified LiDAR point cloud (greens: three vegetation classes; yellow: buildings; orange: ground)

Figure 3: tree canopy derived from LiDAR point cloud

For more information, please contact Nancy Golubiewski, nancy.golubiewski@aucklandcouncil.govt.nz

Recent research activities

RIMU's scientists, researchers, technical specialists and analysts have assisted with many Auckland Council projects over recent months. A list of new publications and information about research related activities follows. The reports noted here are available on the Knowledge Auckland website.

New reports

- *Auckland air emissions inventory 2016,* TR2019/024
- *Auckland regional household labour force survey: quarterly overview. September 2019*
- *Evaluating likelihood and consequence: understanding the New Lynn storms of 2017,* DP2019/003
- *An evaluation of the Waiheke governance pilot: progress after the first 18 months,* TR2019/020
- *An exploration of affordable housing policies in Auckland,* DP2019/005
- *The labour market and skills in Auckland 2009-2019,* TR2019/022
- *Living in Addison: an investigation into the lived experience of a master planned housing development in Auckland,* TR2019/023
- *Review of the 2016-2019 Auckland Council demographic advisory panels,* TR2019/021
- *Safeswim impact evaluation: Aucklanders' awareness and behaviour one year on*, TR2019/026

2018 Census information sheets

We published 2018 Census information sheets in October including:

- One for each local board
- All Auckland
- The Auckland City Centre
- The Southern Initiative
- The Western Initiative

Other topic based information sheets are in preparation including ethnicity – Asian people, European, Māori, Pacific peoples etc.

The information sheets are available on Knowledge Auckland.

Lakes380 sampling at Lake Pupuke

A collaborative national project involving GNS Science, the Cawthron Institute and regional councils that collects a detailed history of 10 per cent of New Zealand's lakes using various molecular and paleolimnological techniques. We had people from Ngati Maru for a cultural knowledge sharing prior to sampling – a great way to understand the spiritual and cultural significance of Lake Pupuke as well as its history. The 2m long sediment cores extracted will provide information on lake condition dating back up to 2000 years.

Mudfish

RIMU scientist Kolt Johnson is working with council's Environmental Services teams on a project to restore shallow groundwater levels in a private wetland near Te Arai, that is home to a population of black mudfish. A complex network of historic drainage channels is in place for farming. The new landowner is keen to modify the drains to raise groundwater and increase available habitat for the black mudfish population.

Emerging contaminants and microplastics

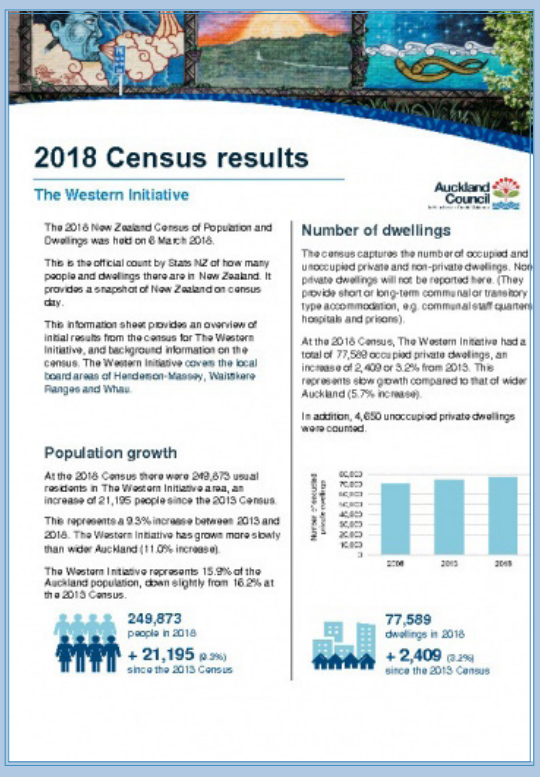
Dr Megan Carbines attended a workshop with EcoMatters and Te Kawerau a Maki, part of MBIE-funded Emerging Contaminant and Microplastics research programmes. The aim of the proposed research is to work with community and iwi groups to identify potential levers for change, both policy and behaviour, and to embed the biophysical research on these contaminants and their effects in community efforts.

New Zealand International Convention Centre fire, October 2019

In response to concerns about the impact of contaminated water from firefighting, the RIMU Water Quality Team took samples from both within the fire emergency cordon and at the Daldy St outfall. Samples were tested for a range of water quality parameters and ecotoxicity. The team provided technical support to Healthy Waters who were providing expert advice for the media.

Quality of Life Survey

Planning for the 2020 survey has begun. Auckland Council is one of several New Zealand councils supporting the survey. It's held every two years. See www.qualityoflifeproject.govt.nz



2018 Census results

The Western Initiative

Auckland Council

The 2018 New Zealand Census of Population and Dwellings was held on 6 March 2018.

This is the official count by Stats NZ of how many people and dwellings there are in New Zealand. It provides a snapshot of New Zealand on census day.

This information sheet provides an overview of initial results from the census for The Western Initiative, and background information on the census. The Western Initiative covers the local board areas of Henderson-Massey, Waitākere Ranges and Whau.

Number of dwellings

The census captures the number of occupied and unoccupied private and non-private dwellings. Non-private dwellings will not be reported here. (They provide short or long-term communal or transitory type accommodation, e.g. communal staff quarters, hospitals and prisons).

At the 2018 Census, The Western Initiative had a total of 77,589 occupied private dwellings, an increase of 2,409 or 3.2% from 2013. This represents slow growth compared to that of wider Auckland (5.7% increase).

In addition, 4,650 unoccupied private dwellings were counted.

Population growth

At the 2018 Census there were 249,873 usual residents in The Western Initiative area, an increase of 21,195 people since the 2013 Census.

This represents a 9.3% increase between 2013 and 2018. The Western Initiative has grown more slowly than wider Auckland (11.0% increase).

The Western Initiative represents 15.9% of the Auckland population, down slightly from 16.2% at the 2013 Census.

249,873 people in 2018

+ 21,195 (9.3%) since the 2013 Census

77,589 dwellings in 2018

+ 2,409 (3.2%) since the 2013 Census

Bees in the city!

Circular place-making in Auckland: enhancing pollinators' biodiversity and food awareness

Kyle Balderston (Principal Growth Analyst), Chad Hu (Growth Analyst) and Barbara Ribeiro (Research Analyst) used council's GIS, GeoMaps to map pollinators' pathways across the city (Map 1) and possible opportunities for new food growing sites in the Waitematā Local Board (Map 2) – taking a circular approach to place-making.

The project comes from recent research that demonstrates how pollinators (bees and other insects) are dying in rural areas, whereas the city has become a refuge from chemical pesticides and fertilisers where insect pollinators are thriving (Hall et al. 2017).

Some researchers estimate that between 70 and 84 per cent of all foods are pollinated by insects; especially bees (see Gallai et al. 2009). We have used this premise to propose the mapping of gaps in pollinators' pathways in Auckland (with a focus on bees) coupled with opportunities for growing new urban food gardens in Auckland.

The emphasis on urban practices concerns not only increasing the biodiversity of pollinators in Auckland but the potential for New Zealand cities to become strategic hot-spots of pollinators' biodiversity on a national level. Barbara met with the Ministry for the Environment to discuss these ideas, and the Waitematā Local Board was our case study area.

Map 1 shows schools and community gardens that are currently growing foods or engaging in beekeeping practices in the Waitematā Local Board. It also demonstrates the methodology for mapping pollinators' pathways, with a focus on bees.

Bees fly on average 3.2km per day, which is the diameter of the blue circles (with existing beekeeping sites at the centre). We took a conservative approach because bees will not fly around the blue circles just because we drew them: the food sources attract bees. This methodology could be refined if coupled with the mapping of pollen and nectar sources in the catchment area. Barbara used Landcare Research's satellite mapping of pollen and nectar areas, however, Landcare Research utilised one hectare per data point catchment. We need a better resolution for our scale of analysis – an opportunity for further research.

We worked with Auckland Council colleagues to co-design a strategy for closing the gaps identified in the pollinators' pathways while enhancing food awareness in Auckland. A twofold approach emerged from these conversations: we discussed potential schools that could start beekeeping and mapped the pervious, publicly owned land where Auckland Council could help enable new food gardens (Map 2).

Map 2 overlaps impervious soil (building footprints and impervious surfaces) on to publicly owned land. The coloured areas that emerged comprise pervious, publicly owned land, which could be places for new urban food growing sites. If new food growing sites prioritise crops and flowers that attract pollinators, they would strengthen Auckland as a nest for pollinators' biodiversity to thrive while potentially encouraging the social value of raising food growing awareness among Aucklanders. A place-based analysis of the opportunities would be paramount to determine both if growing foods in parts of each pocket of pervious, publicly owned soil is feasible or not, and which crops would be suitable.

This project highlights one way of keeping multiple values circulating within valuable, urbanised land through an innovative approach to place-making (Ribeiro 2019).

For more information please contact Barbara Ribeiro, barbara.ribeiro@aucklandcouncil.govt.nz

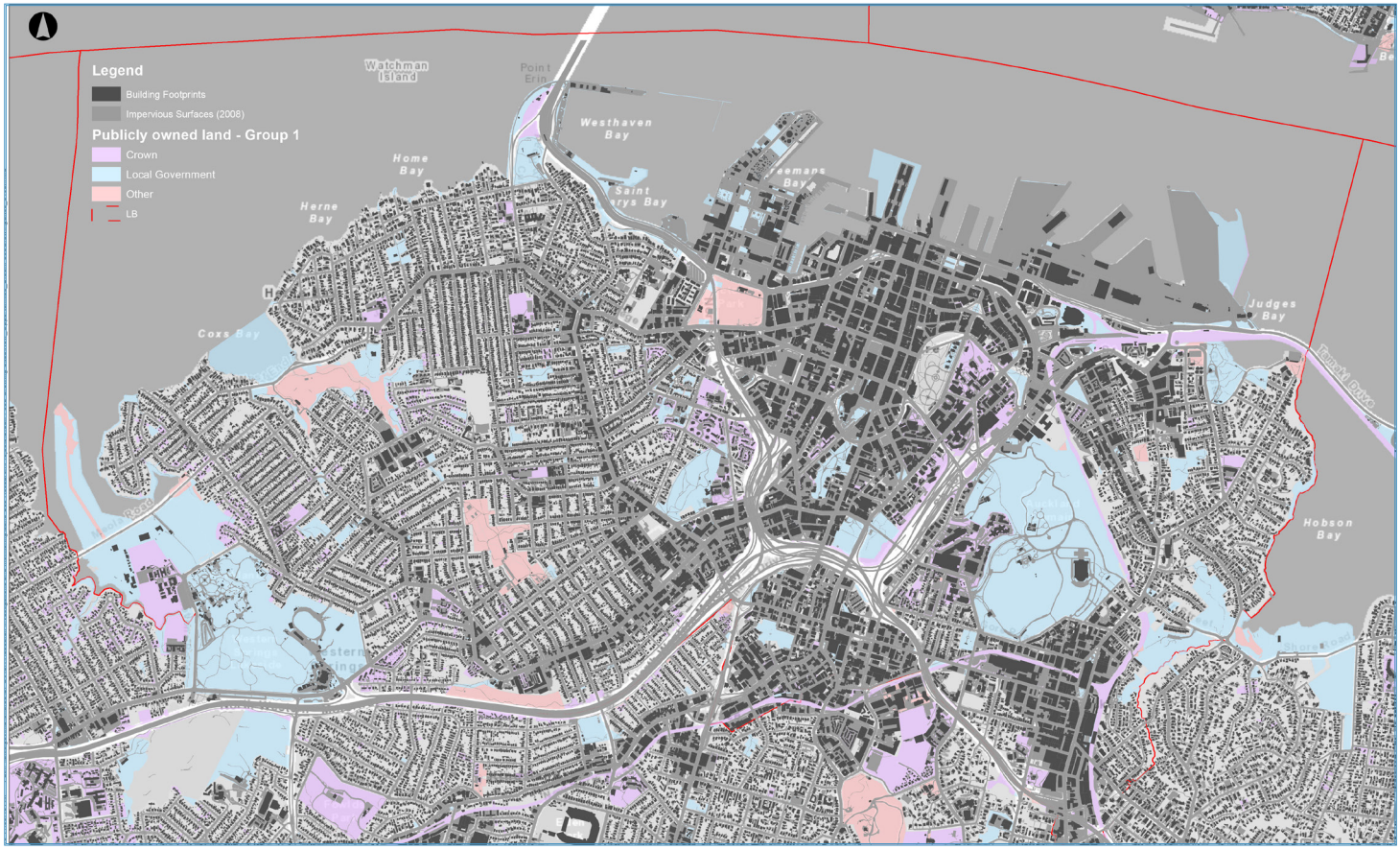
References

Gallai, Nicola, Jean-Michel Salles, Josef Settele and Bernard E. Vaissière. 2009. "Economic valuation of the vulnerability of world agriculture confronted with pollinator decline." Ecological Economics 68 (3): 810-21. https://doi.org/10.1016/j.ecolecon.2008.06.014

Hall, Damon M., Gerardo R. Camilo, Rebecca K. Tonietto, Jeff Ollerton, Karin Ahrné, Mike Arduser, John S. Ascher, et al. 2017. "The city as a refuge for insect pollinators." Conservation Biology 31 (1): 24-29. https://doi.org/10.1111/cobi.12840

Ribeiro, Barbara. 2019. "From food consumption to eating awareness." Focus: The Journal of Planning Practice and Education 15 (1). https://digitalcommons.calpoly.edu/focus/vol15/iss1/14

Map 1: pollinators' pathways across the city



Map 2: possible opportunities for new food growing sites in the Waitematā Local Board

Auckland Plan 2050 Development Strategy report

The results of the first monitoring report for the Auckland Plan 2050 Development Strategy were published on the Auckland Plan 2050 website in October.

The Auckland Plan Development Strategy describes how Auckland will grow and change over the next three decades. Auckland has taken a quality compact approach to growth and development, which encourages future development in existing and new urban areas, limiting expansion into rural areas. Monitoring helps council to understand trends and the progress that is being made.

Annual reporting on the Development Strategy has been carried out since the first Auckland Plan was adopted in 2012. The monitoring report uses building consent and code compliance certificates (CCCs) data to provide information on dwellings consented and completed, by location and type.

This year for the first time, and in addition to a written report, information is presented as a spatial dashboard, enabling users to zoom into specific areas to see how the Auckland region is growing. While it is too early to be sure if we are achieving a quality compact approach to growth and development, the findings indicate a strong shift towards more intensive housing types within the existing urban area.

The monitoring report shows that 14,032 new dwellings were consented in the year ended 30 June 2019. This was a 13 per cent increase from the previous year. Of these, 83 per cent were for dwellings located inside existing urban areas.

Limiting the city's spread into rural areas not only helps protect productive land and rural character, it means more investment can go into improving existing infrastructure. For example, more investment in improving public transport helps to enhance the vitality of existing communities.

More attached dwellings in existing urban areas

Although standalone houses remain the predominant dwelling type region-wide, more than half of new dwelling consents issued in existing urban areas are now for more intensive housing, including apartments, townhouses, flats, units and other dwellings.

The pattern of consented activity within the existing urban area has become more focused in locations in and around centres and along major public transport corridors. Collectively, more intensive housing such as apartments and townhouses made up 76 per cent of all dwellings consented in nodes and 68 per cent of dwellings consented in development areas. This shows Auckland is beginning to deliver the right housing in the right place.

Managed expansion into future urban areas

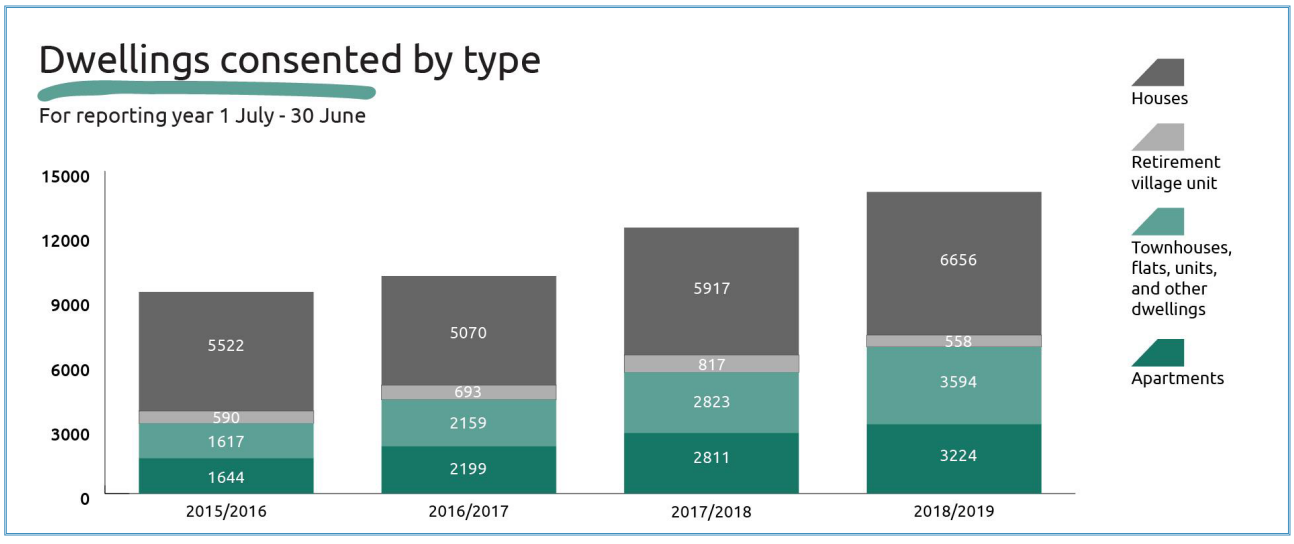
In 2018-19, 1434 dwellings were consented in future urban areas. This is approximately 10 per cent of all dwellings consented. Of these dwelling consents, 1087 were issued in future urban areas sequenced in years 1-3 of the strategy. This shows that consents are being issued in line with the sequencing set out in the strategy.

Why we do it

Annual reporting on the Development Strategy helps support strong evidence-based decision-making by elected members and council staff on growth related matters. Reporting has improved as the more and better data has become available. Council has begun reporting more extensively on code compliance certificates as well as consents, and on a greater range of housing types.

The shift to digital-first (the online report) and development of interactive dashboards has made navigation simpler and allowed for much more detailed insights on development trends in specific locations than was previously possible with printed or pdf reports. This information not only assists transparency, it can also help inform changes to the strategy if required.

For more information, please visit the Auckland Plan 2050 website for the online report and interactive dashboards, or contact Luke Carey, Advisor, Growth and Spatial Strategy, luke.carey@aucklandcouncil.govt.nz or Alyssa Jones, Senior Advisor, Growth and Spatial Strategy, alyssa.jones@aucklandcouncil.govt.nz



Pesticides and emerging organic contaminants in groundwater

Groundwater is the water that is present in the pore spaces of soil and earth materials. Rainfall that infiltrates into the ground is the source of water for aquifers. Aquifers are generally made of sands, gravels, and other earth materials that allow water to easily flow through the tiny spaces between grains.

The Auckland Council state of the environment groundwater monitoring network measures water level and water quality at regular intervals to describe the state of the region's aquifers; facilitate understanding of long-term trends, and use that understanding to inform policy. The groundwater quality programme includes 15 sites and measures physical, chemical, and microbiological parameters in nine aquifers.

The National Survey of Pesticides in Groundwater is conducted every four years by the Institute of Environmental Science and Research (ESR) on behalf of New Zealand's regional councils. The survey began in 1990, with eight surveys since then and the most recent completed in 2018.

Pesticides (herbicides, fungicides and plant growth regulators) are commonly used throughout New Zealand in the agricultural, forestry and horticulture industries and so it is important to monitor their traceability in groundwater supplies.

Emerging organic contaminants (EOCs) are natural or manufactured chemicals in household and personal care products, pharmaceuticals, and agrichemicals. Many are in common everyday use, persistent and can affect ecosystem and human health but we know little about their concentrations and impacts in the environment. Emerging organic contaminants were monitored for the first time in the 2018 survey.

Eight Auckland Council groundwater monitoring sites were included in the current survey. These sites met the following criteria:

- known pesticide use in the surrounding area
- significant or important regional aquifers
- shallow, unconfined aquifers (potential increased vulnerability to aquifer contamination)
- and if possible, sites that had been sampled for previous surveys to provide temporal information.

Sites were also selected based on 2014 detections and wells that had not been sampled in the last eight years. Samples were collected by RIMU staff in October 2018 and sent to ESR for analysis.

Pesticides

Of the eight Auckland groundwater quality bores sampled, pesticides were detected in four (all detections were in the herbicide category). None of the pesticide concentrations detected in any of the four bores exceeded their respective Maximum Accepted Value (MAV) for drinking water (see p26 in the full report for individual MAVs).

Bentazone was the most commonly detected pesticide, metolachlor was found in one bore and 2, 4_DB in another (see table 4 in the full report).

Emerging organic contaminants

While the detection of EOCs in water has improved over the last decade, there are currently no MAVs for EOCs and guidelines are lacking as there is insufficient research available to determine at what concentrations each of the many contaminants become problematic. In the current report, EOCs have been divided into six categories representing their source and usage: 1.) antimicrobial/preservative; 2.) estrogenic steroid hormones; 3.) human wastewater tracer; 4.) industrial; 5.) pharmaceuticals; 6.) UV filter/stabiliser.

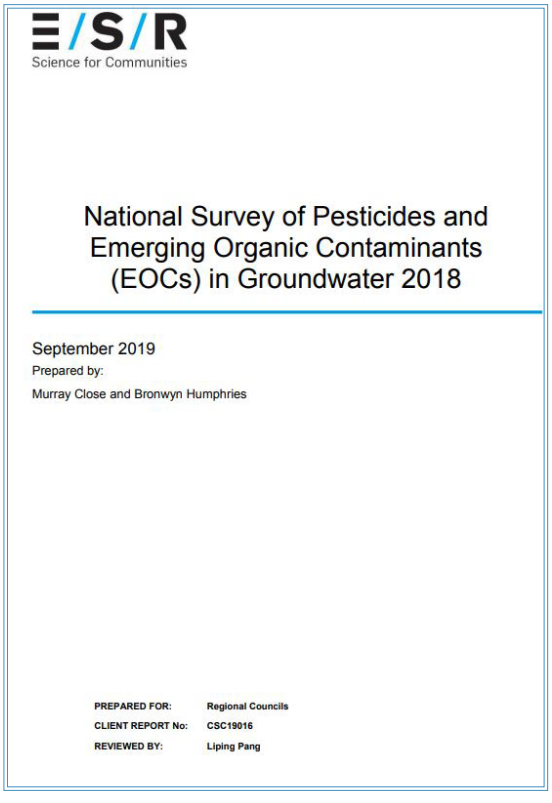
EOCs were recorded in all the groundwater bores sampled by Auckland Council (see Table 6 of the full report for results).

Sucralose, an artificial sweetener, along with caffeine are indicators of wastewater contamination or human inputs and were detected in two bores. Bisphenol-A (BPA), is a starting material for plastics and has been identified to have estrogen-mimicking properties and was detected in five bores. Anti-inflammatories such as ibuprofen, naproxen and diclofenac together were detected in three bores. Steroid estrogens (estrone and 17α-estradiol) were detected in relatively low concentrations in four bores. Octinoxate (found in some sunscreens and lip balms) was detected in two bores.

Table 7 of the full report is a summary of the EOC detections and concentrations across all participating councils. For example, caffeine concentration in Auckland (well 43915) was found to have the maximum detection limit in all wells and BPA (27 ng/L, found in well 6475015) sits around the mean of all detections.

For further information please read the full report: *National survey of pesticides and emerging organic contaminants (EOCs) in groundwater 2018* available on the ESR website.

For historic pesticides reports and other questions, please send your requests to environmentaldata@aucklandcouncil.govt.nz


ESR
Science for Communities

National Survey of Pesticides and Emerging Organic Contaminants (EOCs) in Groundwater 2018

September 2019

Prepared by:

Murray Close and Bronwyn Humphries

PREPARED FOR: Regional Councils

CLIENT REPORT No: CSC19016

REVIEWED BY: Liping Pang

Real time water quality monitoring and managing mud – Te Wairoa, Tāmaki Strait

The Research and Evaluation Unit is collaborating with NIWA to deploy water quality buoys in the Te Wairoa, Tāmaki Strait area.

NIWA is leading Managing Mud, a six-year project which started in 2017, dedicated to understanding the dynamics of how fine sediments move from catchment to sea, which land use source they come from, and how they influence estuary evolution. The project includes input from universities, regional councils, and iwi to provide knowledge, methods, and tools to assist with the implementation of government policies that aim to maintain and improve environmental and cultural values in waterways affected by sediment and other contaminants.

RIMU water quality buoys will initially be deployed for one year to collect turbidity, dissolved oxygen, temperature, salinity, and organic matter data in real time, every ten minutes.

Deploying the buoys serves two main purposes:

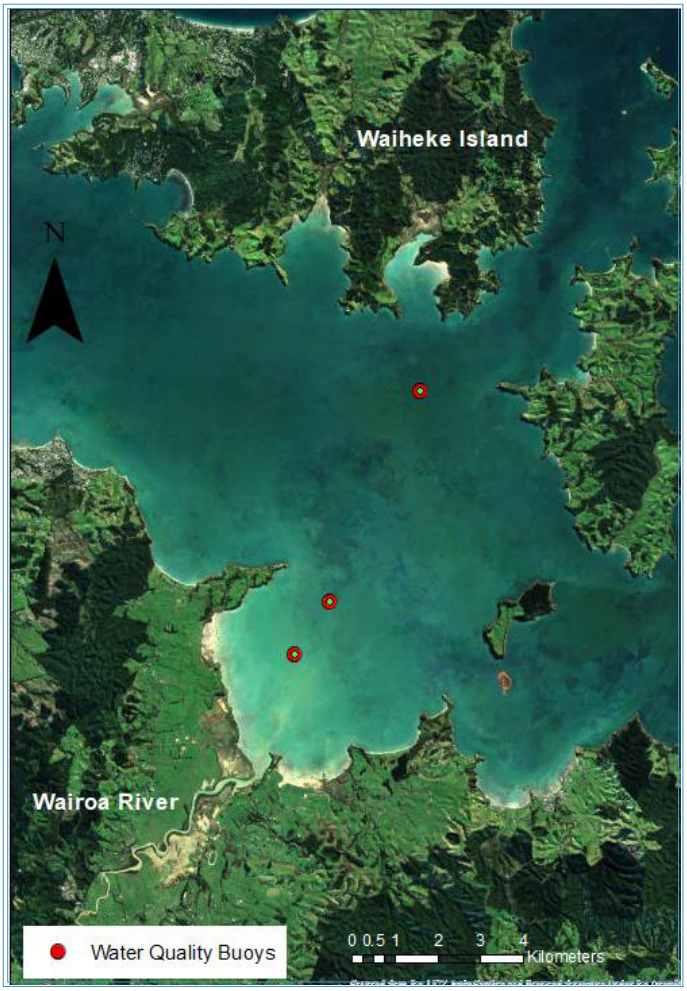
1. To establish a relationship between episodic rainfall events and measured sediment signals (coming from the Wairoa River) in the coastal receiving environment with improved understanding of when and where sediment is going.

2. To calibrate NIWA's hydrodynamic sediment plume model.

The development of continuous water quality monitoring buoys will supplement our existing monthly water quality sampling network by providing data captured during rainfall events on sediment delivery to the marine environment. The use of mobile buoys also means we can target specific questions relevant to particular catchments.

This partnership with NIWA in Wairoa, will allow us to develop the use of coastal water quality buoys for many other applications across the region in the future.

For more information send your questions to environmentaldata@aucklandcouncil.govt.nz



Locations of the three proposed continuous water quality buoys in the Te Wairoa, Tāmaki Strait

For more information about Auckland related research, data and monitoring programmes visit the Research Unit's websites:

Knowledge Auckland

www.knowledgeauckland.org.nz

Auckland Counts, census data

www.censusauckland.co.nz

Environmental data portal

www.environmentauckland.org.nz

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