



FORECASTING WATER QUALITY IN THE WAITEMATĀ HARBOUR

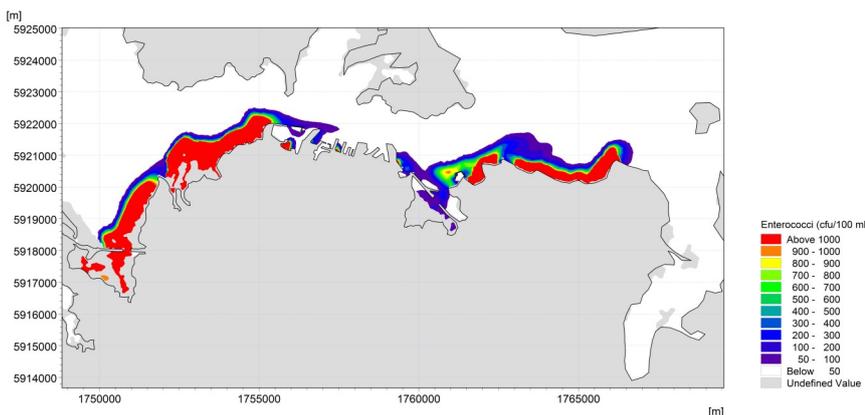
Bathing water forecast system ensures timely and accurate information for swimmers

In addition to the local population, flocks of tourists enjoy sea-sides, rivers and lakes across the world each year. Tourism is the world's third largest industry and the prime economic sector in some regions. It cannot be compromised by health incidents or concerns. Meeting water quality standards and providing easily accessible and timely information to the public is a very real and current need.

ENSURING SAFE DISCHARGES INTO RECREATIONAL WATER

Sewage outfalls, storm water overflows, plant releases, agricultural production effluents—water bodies in urban areas are subjected to many polluted discharges. When these water bodies are also used for recreational purposes, the safety of the population may be at risk.

A central Waitematā Harbour water quality forecast model, underpinned by a 3D hydrodynamic model has been developed to provide water quality forecasts to inform risk for recreational activity from overflows at central Auckland beaches from Point Chevalier to St Heliers Bay.



Contaminant Plume Tracker. ©DHI

Predictions from the model are presented as part of Safeswim. Safeswim is a collaboration between Council Group, Surf Lifesaving Northern Region and the Auckland Regional Public Health Service.

CALCULATING THE CONCENTRATION OF ENTEROCOCCI BACTERIA

The system constantly monitors the harbour's water and predicts the concentration of the indicator bacteria Enterococci at specified locations along the water course in the harbour.

CLIENT

Auckland Council

CHALLENGE

- Local bathing locations inside the Waitematā Harbour were exposed to risks of contamination
- Insufficient data on pollution levels and currents
- Public scepticism about the quality of water in the harbour was escalating

SOLUTION

- Constant monitoring of the harbour's water and prediction of the concentration of Enterococci bacteria
- Creation of models for predictive forecasts by utilising a high-resolution 3D hydrodynamic model to simulate tidal and wind driven currents
- Generating flow and bacteria concentration time series based on observed and predicted rainfalls time series
- Information available on the need to clean up waterways

LOCATION / COUNTRY

New Zealand

SOFTWARE USED

MIKE 21 / MIKE 3

To help forecast frequent pollution threats, DHI also collects meteorological data from forecast suppliers and runs hydrodynamic models to retrieve data. All of this information is then used to create models to demonstrate predictive forecasts using MIKE Powered by DHI software, by utilising a high-resolution 3D hydrodynamic model, MIKE 3 FM. The model simulates tidal and wind driven currents within the harbour.

During a rainfall event, calculated loads of Enterococci are discharged within the hydrodynamic model and the resulting transport, dilution and inactivation of the Enterococci plume are simulated as a tracer. Within the Waitematā Harbour, the main sources of pollutants to the harbour are combined wastewater and stormwater outfalls as well as freshwater inflows.



Water quality information displayed at Mission Bay Beach, Auckland. © DHI

PROVIDING FORECASTS AHEAD OF TIME

The model is currently configured to provide forecasts three days into the future and was developed to address some of the short comings of traditional recreational water quality monitoring.

MIKE OPERATIONS is the platform which operates the forecast system. It is a software product designed for model-based forecast services and for online operational control of river systems, water collection systems and water distribution systems.

Every six hours, MIKE OPERATIONS downloads data from required sources. It then converts the data to a MIKE format, generating the flow and bacteria concentration time series based on the observed and predicted rainfalls time series.

CLIENT TESTIMONIAL

“DHI’s solution overcame the limitations of monitoring programmes with its ability to predict water quality outcomes ahead of time. This allows us to provide the public with water quality information and associated health risks just before they enter the water. Previously, with the monitoring approach, the best we could do was advise the public about water quality retrieved two days before they wanted to go for in for a swim.”

Dr Martin Neale—Safeswim lead and independent environmental scientist

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Model simulations are carried out every six hours using the latest three-day forecasts of precipitation, solar radiation and wind. Forecast wind and solar radiation data, coupled with a three day precipitation forecast on an hourly interval, are provided for selected locations within the Auckland region. Observed rainfall for appropriate rain gauges is provided by the local council authority.

To ensure that the model captures significant rain events, the model carries out a simulation using measured rainfall

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data (a ‘nowcast’) before proceeding into the forecast for the next three days. This method ensures where a rainfall event was forecast but did not occur, the predicted bacteria load to the harbour is not included in the next forecast.

A SOLUTION FOR BATHERS

Greater information about water quality is now available, which in turn may help to reduce the impact of pollutant discharges, meet regulatory standards, monitor water quality and provide users with timely information.

Water quality predictions are also accessible for beach safety throughout 84 beaches within the Auckland Region over the summer bathing season. The majority of these are through a regression type model forecast, with nine central Waitematā Harbour locations from Point Chevalier to Saint Helier’s targeted through DHI’s modelling engines.

The software utilises actual information on meteorological forcings and simulates the fate of the indicator bacteria with precise hydrodynamic models. Hence, the model system can also be used as a highly effective tool to assess and identify the best method to address solutions to maintain water quality and reduce risk of pollution.

The Auckland Council is the local government council for the Auckland Region in New Zealand and is the largest council in Oceania. Safeswim is a collaboration between Council Group, Surf Lifesaving Northern Region and the Auckland Regional Public Health Service.