

Army Bay Wastewater Treatment Plant
Receiving Environment Monitoring 2025-2026

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Watercare
An Auckland Council Organisation

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EXECUTIVE SUMMARY

Watercare Services Limited (Watercare) runs a wastewater treatment plant at Army Bay that services the Whangaparāoa Peninsula and surrounding townships. This plant discharges treated wastewater via an outfall to the Hauraki Gulf.

Condition 18 of the DIS60331146 consent requires a Receiving Environment Monitoring Plan (REMP). This plan includes the collection and analysis of monthly water quality and annual shellfish data. Water quality sampling began in March 2020.

2025-2026 reporting year:

The 2025–26 receiving water quality results were generally similar across the monitoring transect, with no statistically significant spatial differences detected for nitrate, total oxidised nitrogen, dissolved reactive phosphorus, total nitrogen or chlorophyll-a. Seasonal analyses of winter nutrient concentrations and summer chlorophyll-a concentrations also identified no statistically significant differences between sites.

A statistically significant difference in pH was detected between N1000 and S2000; however, the magnitude of the difference was small (approximately 0.1 pH units), did not demonstrate a clear distance-from-outfall gradient, and is unlikely to represent an ecologically meaningful discharge effect.

Long term spatial patterns

Analysis of the 2020–26 monitoring dataset identified statistically significant spatial differences for nitrate and dissolved reactive phosphorus. Nitrate showed the clearest pattern, with higher and more variable concentrations at the inner sites located 200 m from the outfall and lower concentrations at the outer- and reference sites. Dissolved reactive phosphorus showed a weaker spatial pattern with substantial overlap between site groups. Overall, these results indicate a localised nutrient signal associated with the outfall, particularly for nitrate.

Shellfish

All measured inorganic arsenic, cadmium, lead and mercury concentrations in shellfish were below the relevant FSANZ guideline values. Spatial analysis identified significant differences for cadmium and mercury after correction for multiple comparisons. Cadmium concentrations were highest at Tiritiri Matangi Island, while mercury concentrations were highest at Whangaparāoa Head. There was no consistent pattern of metal concentrations being highest at sites closest to the outfall, indicating that the observed spatial differences are unlikely to be explained solely by the Army Bay discharge.

Benthic ecological and sediment monitoring is undertaken separately under the REMP. The findings from the most recent ecological surveys should be considered alongside the water quality results presented in this report when assessing whether the observed nutrient signal is associated with any measurable ecological response.

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ABBREVIATIONS

For ease of reading, this report uses abbreviations for some technical terms. Table 1-1 lists these abbreviations.

Table 1-1: Abbreviations

Abbreviation	Description
$cBOD_5$	5-day carbonaceous biochemical oxygen demand
DO	Dissolved oxygen
E. coli	*Escherichia coli*
NH_x-N	Ammonia and ammonium, reported in milligrams nitrogen
NO_3-N	Nitrate as measured in units of nitrogen
TN	Total nitrogen
DRP	Dissolved reactive phosphorus
TSS	Total suspended solids
Watercare	Watercare Services Limited
WWTP	Wastewater treatment plant

1 Introduction

1.1 Background

Watercare Services Limited (Watercare) runs a wastewater treatment plant at Army Bay that services the Whangaparāoa Peninsula and Hatfields Beach, Orewa and Silverdale townships. This plant discharges treated wastewater via an outfall to the Hauraki Gulf.

Resource Consent DIS60331146 permits the discharge of treated wastewater, subject to conditions including maximum limits for contaminants of concern. The consent also requires regular reporting of water quality monitoring.

Condition 18 of the consent requires Watercare to design and implement a Receiving Environment Monitoring Plan (REMP). This plan includes the collection of monthly water quality and annual shellfish data. Water quality sampling began in March 2020 and has occurred since, contingent on COVID-19 restrictions.

Other aspects of the REMP include benthic ecological and sediment sampling. This work occurs annually, as detailed in a separate report prepared by Bioresearches (Bioresearches 2026[1]).

1.2 Scope

This report summarises receiving environment and treated effluent monitoring undertaken during the 2025–26 reporting year, with long-term receiving water analysis incorporating the monitoring record from 2020 to 2026. In doing so, this report includes:

- A description of the monitoring programme
- Sampling details
- Effluent quality for 2025-2026
- An assessment of receiving water quality and shellfish results for 2025-2026, incorporating the recommendations of the review
- Review of emergent trends.

This report does not include raw data. Raw data in a more appropriate format (e.g., .csv or .xlsx) is available on request.

1.3 Additional details

In 2022 Coast and Catchment reviewed the REMP in accordance with Condition 21 of the consent. With respect to water quality reporting, the review recommended:

- Including dissolved oxygen data
- Assessing nutrient data in winter months; and
- Assessing chlorophyll-a data in summer months.

A copy of the review was included with the 2021-2022 Annual Report for the treatment plant. The current report addresses these recommendations through inclusion of dissolved oxygen results, targeted assessment of nutrient concentrations during winter months, and assessment of chlorophyll-a concentrations during summer months.

[1] Bioresearches (2026). Environmental Monitoring of the Benthos in the Whangaparāoa Passage and intertidal shore - Army Bay Wastewater Treatment Plant. Report for Watercare Services Ltd.

2 Operational details

2.1 Current operations

The Army Bay Wastewater Treatment Plant (WWTP) is on the eastern edge of the Whangaparāoa Peninsula (Figure 2-1). The WWTP is an activated sludge plant that uses the following treatment devices and processes for the treatment of wastewater and management of biosolids:

- Screening and grit removal
- Sequencing batch reactors
- Sludge dewatering (gravity belt thickener and centrifuge)
- Biofilters
- Balancing ponds (to control the rate of effluent discharge)
- UV disinfection

Treated effluent discharges via an outfall to the Whangaparāoa Passage in the Hauraki Gulf. All dewatered biosolids go to a permitted worm farm.



Figure 2-1 Aerial image of the Army Bay WWTP

2.2 Changes in reporting year

No significant operational, infrastructure or process changes occurred during the reporting period that materially affected plant operation, monitoring or consent compliance.

2.3 Future changes

Future changes at the Army Bay WWTP are focused on increasing treatment capacity and improving resilience as flows to the plant continue to grow. The broader Stage 1 upgrade programme is

currently in feasibility and design, with the main liquid stream upgrade expected to be operational by 31 December 2030, in line with consent requirements.

Ahead of the wider Stage 1 works, upgrades to the UV disinfection system have been prioritised to address the capacity constraints observed during elevated flow conditions. Construction is scheduled to begin in summer 2026, with two additional UV banks planned for installation in early to mid-2027. A further UV channel, comprising six banks, is expected to be completed in late 2027.

Once completed, the UV works are expected to more than double disinfection capacity and improve the plant's ability to maintain the required UV dose during wet-weather events and other periods of high flow. This is expected to reduce the likelihood of recurring UV-related non-compliance. Until the upgrades are commissioned, discharge volumes, UV performance and receiving environment monitoring will continue to be reviewed to assess compliance risk and any associated environmental effects.

3 Methodology

3.1 Monitoring

Figure 3-1 shows the treatment plant, outfall, and sampling locations. Water quality samples come from three sites north and three sites south of the outfall's diffuser. The REMP defines the sites at 2,000 m as reference sites, with the closer sites (200 m and 1,000 m) being effects sites. Treated effluent data comes from the WWTP before it enters the outfall (immediately after UV treatment).

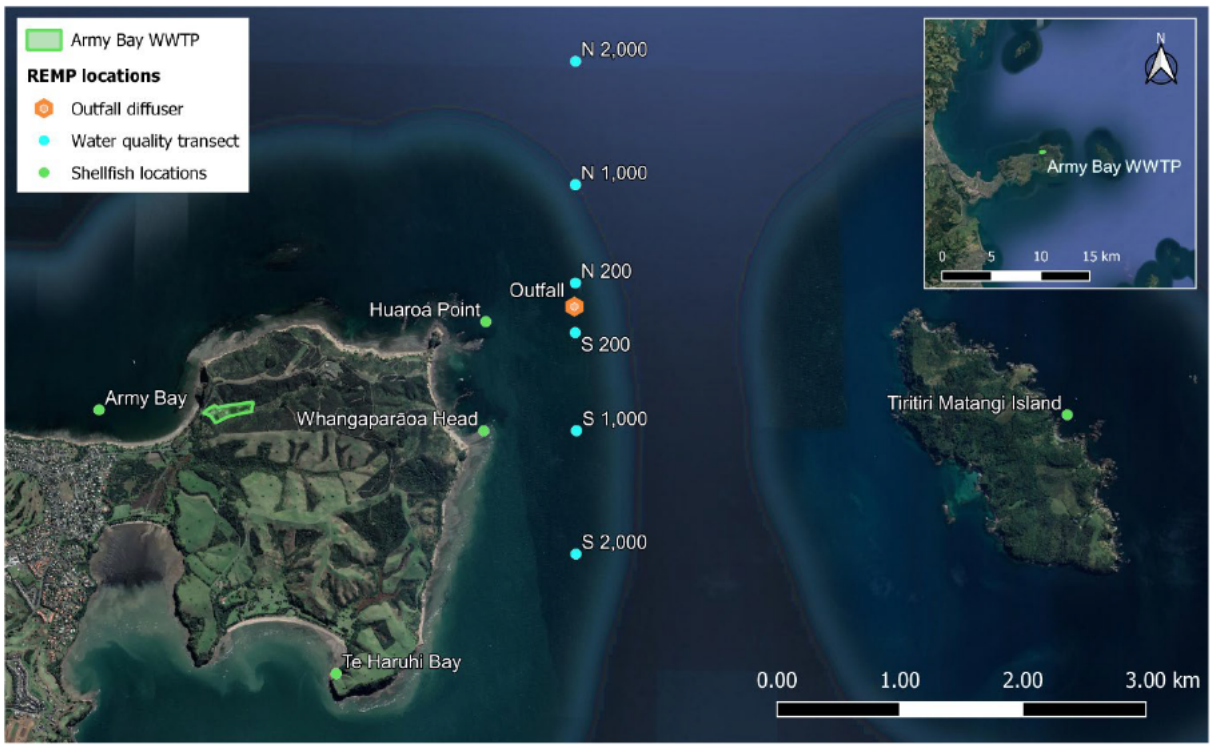

Figure 3-1 Army Bay REMP sampling locations

Watercare collects water quality samples every month, while shellfish sampling occurs annually in summer. Water quality sampling began in March 2020. COVID-19 lockdowns prevented access in April 2020 and for August-October 2021. There have been no sampling issues since.

Table 3-1 lists the parameters that Watercare routinely measures in treated effluent and Hauraki Gulf water samples. Field staff measure temperature, salinity, pH, and dissolved oxygen in situ using calibrated hand-held meters. Watercare Laboratories Services analyse the rest of the parameters at their IANZ accredited laboratory.

Table 3-1 Water quality parameters measured in Hauraki Gulf water quality samples

Parameter	Relevance
Physicochemical	
Temperature	Ecological health
Conductivity	Seawater dilution indicator
Salinity	Seawater dilution indicator
pH	Ecological health
Dissolved oxygen (DO)	Ecological health
Total suspended solids	Ecological health/Recreational contact

Parameter	Relevance
Turbidity	Ecological health/Recreational contact (Hauraki Gulf only)
Chemicals and nutrients	
Ammoniacal nitrogen	Ecological health
Total oxidised nitrogen (nitrite ± nitrate)	Ecological health
Total nitrogen	Eutrophication
Dissolved reactive phosphorus	Eutrophication
Total phosphorus	Eutrophication
Biological indicators	
Chlorophyll-a	Eutrophication
Enterococci spp.	Human health
Faecal coliforms	Human health

Shellfish samples are collected annually from five coastal sites. At each location, samplers collect five replicate samples for individual analysis. Shellfish analytes include bacterial indicators, adenoviruses, enteroviruses, and some heavy metals. The heavy metal suite comprises arsenic, cadmium, lead, and mercury. Except for viruses, analyses occur on separate replicates. The viral analysis is on a composite of all five replicates (per site).

3.2 Data handling and analysis

The following data handling and analysis steps were completed for this report:

- Compiled and summarised treated effluent quality data for the 2025-2026 reporting period, including sample counts, medians, minimums, 92nd percentiles, maximums, and consent limits where applicable for comparison with last year's results.
- Compiled and summarised the 2025-2026 receiving water quality results by monitoring site, with mean values and standard errors presented for each parameter.
- Assessed spatial differences in receiving water quality among monitoring sites using mixed-effects modelling, including F statistics, degrees of freedom, and p values.
- Completed post-hoc testing where a statistically significant difference was detected, including the pH comparison between N1000 and S2000.
- Completed targeted seasonal analyses using linear mixed-effects models – equivalent to repeated-measures ANOVA – to assess spatial differences among Army Bay monitoring sites. Nutrients were analysed for the Winter period (June-September) to assess potential nutrient enrichment, while chlorophyll-a was analysed for the summer period (January to April) to assess potential primary-production effects, Sampling date was included as a random effect to account for measurements collected across sites on the same sampling occasion.
- Assessed long-term trends across the monitoring record from 2020 to 2026, including comparisons between inner effects, outer effects, and reference site groups.
- Identified statistically significant long-term site-group differences.
- Compared *E. coli* concentrations with food safety guideline values.
- Summarised shellfish heavy metal results on a wet-weight basis to allow comparison with food safety guidelines. Laboratory-reported metal concentrations were converted from dry weight to wet weight using the moisture content measured for each composite shellfish sample. Wet weight concentrations were calculated as:

Wet weight concentration = Dry weight concentration × ((100 – % moisture)/100)
where the dry matter fraction was derived from the percentage moisture content of the sample.

- Compared inorganic arsenic, cadmium, lead, and mercury concentrations in shellfish with FSANZ guideline values and assessed whether further action was required.
- Examined shellfish heavy metal concentrations for differences among sites and considered whether observed patterns were consistent with proximity to the Army Bay WWTP outfall.

All operational and monitoring records, including PI tag IDs, SCADA outputs, and laboratory results are collated in Appendix A (Data Sources).

3.3 Compliance criteria

Watercare assesses compliance with consent using the same compliance rating system utilised by the Auckland Council.

Table 3-2 Compliance assessment criteria

Rating	Detail
Category 1	Watercare has complied with the consent condition. Where a consent condition refers to a provision in a Management Plan, then the plan has been referred to in assessing consent compliance
Category 2	Watercare has not complied with the consent condition. Watercare has assessed the non-compliance as technical or having no more than minor adverse effect
Category 3	Watercare has not complied with the consent condition. Watercare has assessed the non-compliance having the potential to result in more than minor adverse effects on the environment. Alternatively, since the last audit, there is evidence of repeat Category 2 non-compliance
Category 4	Watercare has not complied with the consent condition. Watercare has assessed the non-compliance as having the potential to cause significant adverse effects on the environment. Alternatively, since the last audit, there is evidence of repeat Category 3 non-compliance

4 Results

4.1 Treated effluent quality

Table 4-1 is a summary of Army Bay WWTP treated effluent quality data. As reported in the annual performance report to Auckland Council, the WWTP discharge met its consent limits for effluent quality. Average effluent flows were higher than in 2024-2025, as were average temperature, *Enterococci spp.* and faecal coliform levels. But otherwise, results were generally lower than in the last reporting period.

Concentrations of heavy metals were low. In the treated effluent, for which there is no allowance for dilution, concentrations of arsenic, cadmium, lead and mercury and zinc were all below 95%ile trigger values for the protection of aquatic marine ecosystems.

Table 4-1 Army Bay WWTP treated effluent quality (July 2025 – June 2026)

Parameters	Unit	n	Median	Min	92nd %ile	Max	Limit
Physicochemistry							
Daily discharge (all weather)	m3/day	365	13,125↑	8,562	21,414↑	50,615	39,825 (dry weather)
Temperature	˚C	53	20.8 ↑	17.10	23.768 ↓	24.70	
pH	-	52	6.80 -	6.50	7.10 -	7.40	
Cbod5	mg O2/L	51	2.5 ↑	0.6	6.2 ↓	8.3	20 (median)
TSS	mg/L	48	3.7 ↓	0.0	12.2 ↓	22.6	35 (median)
Nutrients							
Ammoniacal nitrogen	mg N/L	53	1.40 ↓	0.08	4.68 ↓	8.20	10 (median)
Nitrite	mg N/L	53	0.11 ↓	0.02	0.64 ↓	0.72	
Nitrate	mg N/L	53	9.94 ↓	6.47	14.60 ↓	16.00	
Total N	mg N/L	52	15.0 ↓	9.2	18.0 ↓	21.0	30 (median)
DRP	mg P/L	53	3.37 ↓	0.38	5.76 ↓	6.82	10 (median)
Total P	mg P/L	53	3.58 ↓	0.54	6.37 ↓	8.47	
Bacterial indicators							
Enterococci	cfu/100 mL	46	38 ↑	<1.6	5,120 ↑	32,000	100 (median)
Faecal coliforms	cfu/100 mL	51	160 ↑	<1.6	28,000 ↑	13,0000	1000 (median)
Heavy metals (total)							
Arsenic	µg/L	2				0.0021	
Cadmium	µg/L	2				<0.00005	
Lead	µg/L	2				0.00028	
Mercury	µg/L	2				<0.00005	

Note: Arrows indicate change from previous year (comparing median and 92%ile values only)

4.2 Water quality results

Table 4-2 summarises water quality, averaged across dates for 2025-2026. Concentrations were generally similar across the transect but varied between sampling dates. Bacterial indicator levels were below or slightly above the laboratory limits of detection in all samples.

Mixed-effects modelling indicated a statistically significant site effect for pH (F = 3.419, p = 0.009) (Table 4-2). Post-hoc testing identified a significant difference between N1000 and S2000, with pH at N1000 averaging approximately 0.1 pH units higher than at S2000. However, this difference was small and did not demonstrate a clear gradient with distance from the outfall. No significant differences between sites were detected for nitrate, total oxidised nitrogen, dissolved reactive phosphorus, total nitrogen or *chlorophyll-a*. Seasonal analyses conducted for winter nutrient concentrations (June-September) and summer *chlorophyll-a* concentrations (January-April) likewise showed no statistically significant differences between sites. Overall, the results indicate that water quality was generally similar among monitoring locations during the 2025-2026 monitoring period.

If the discharge were presenting an ecologically significant source of nutrients, then a corresponding increase in primary production may be expected, including elevated *chlorophyll a* in warmer months. Per Table 4-2, there were no statistically significant differences between sites for chlorophyll in the warmest months (January to April inclusive), nor for nutrients (dissolved reactive phosphorus, ammoniacal nitrogen and nitrate) in the coldest months, when uptake would be lower (June-September inclusive). These results indicate that the differences detected using the whole data set are unlikely to be driving any environmental change.

Table 4-2 Statistical results for key nutrients and chlorophyll a for the reporting period

Parameter	Date Range	Degrees of Freedom	F Statistic	p value
Nitrate	25 Jul 2025 - 17 Jun 2026	55	1.854	0.118
	June-September only (Winter)	15	2.329	0.094
Total oxidised nitrogen	25 Jul 2025 - 17 Jun 2026	55	1.725	0.144
	June-September only (Winter)	15	1.334	0.303
Dissolved reactive phosphorus	25 Jul 2025 - 17 Feb 2026	35	1.146	0.355
	June-September only (Winter)	10	1.695	0.223
Chlorophyll a	25 Jul 2025 - 17 Jun 2026	55	0.421	0.832
	January-April only	15	0.502	0.77
pH	25 Jul 2025 - 17 Jun 2026	55	3.419	0.009*
Total nitrogen	25 Jul 2025 - 17 Jun 2026	55	1.825	0.123
	June-September only (Winter)	18	1.528	0.231

Notes: p<0.05 considered statistically significant. **p* values statistically significant.

Table 4-3 Hauraki Gulf water quality about the Army Bay WWTP - Mean values ± standard error, n=12 (2025-2026)

Parameter	Unit	N2000	N1000	N200	S200	S1000	S2000
Temperature	°C	17.9 ± 0.845	17.8 ± 0.848	17.9 ± 0.861	17.8 ± 0.862	17.8 ± 0.866	17.7 ± 0.865
Dissolved oxygen	mg/L	7.77 ± 0.147	7.66 ± 0.162	7.7 ± 0.16	7.68 ± 0.159	7.68 ± 0.167	7.67 ± 0.178
cBOD5	mg/L	0.504 ± 0.00417	0.517 ± 0.0167	0.551 ± 0.0381	0.51 ± 0.01	0.505 ± 0.00417	0.51 ± 0.01
pH	-	8.16 ± 0.0229	8.17 ± 0.0225	8.16 ± 0.026	8.16 ± 0.026	8.1 ± 0.0326	8.07 ± 0.0432
Conductivity	mS/cm	52300 ± 1170	52300 ± 1170	52400 ± 1180	52200 ± 1080	52100 ± 1070	52100 ± 1070
Salinity	g/L	35.1 ± 0.378	35.1 ± 0.388	35.1 ± 0.404	35.1 ± 0.404	35.1 ± 0.432	35 ± 0.43
Turbidity	NTU	0.371 ± 0.0372	0.508 ± 0.0701	0.529 ± 0.0727	0.525 ± 0.0659	0.838 ± 0.164	0.908 ± 0.153
Volatile solids	mg/L	8.42 ± 0.867	9.58 ± 0.559	9.92 ± 1.17	9.03 ± 0.989	10.2 ± 0.778	9.15 ± 0.596
Total suspended solids	mg/L	39.1 ± 3.48	40.3 ± 3.33	38.9 ± 3.3	43.3 ± 5.44	45.2 ± 3.96	40 ± 3.68
Ammoniacal nitrogen	mg N/L	0.00529 ± 0.000292	0.00583 ± 0.000833	0.0055 ± 5e-04	0.00684 ± 0.00183	0.005 ± 0	0.00633 ± 0.000932
Nitrate	mg N/L	0.00695 ± 0.00121	0.0104 ± 0.00182	0.00835 ± 0.00144	0.0154 ± 0.00457	0.00903 ± 0.00107	0.01 ± 0.00254
Nitrite	mg N/L	0.00116 ± 9.33e-05	0.00122 ± 0.000134	0.00122 ± 0.000129	0.00124 ± 0.000152	0.00115 ± 0.000118	0.00138 ± 0.000229
Total oxidised nitrogen	mg N/L	0.00739 ± 0.00141	0.0111 ± 0.00196	0.00863 ± 0.00141	0.0156 ± 0.00471	0.00939 ± 0.00114	0.0106 ± 0.00257
Total nitrogen	mg N/L	0.0752 ± 0.00526	0.0815 ± 0.00657	0.0834 ± 0.00823	0.0972 ± 0.00987	0.0818 ± 0.00405	0.082 ± 0.00485
Dissolved reactive phosphorus	mg P/L	0.0083 ± 0.000583	0.00951 ± 0.000793	0.00876 ± 0.000698	0.0111 ± 0.00167	0.00925 ± 0.000629	0.0102 ± 0.00105
Total phosphorus	mg P/L	0.0127 ± 0.00132	0.0141 ± 0.00167	0.0158 ± 0.00225	0.0189 ± 0.00322	0.0144 ± 0.00179	0.0148 ± 0.00201
Chlorophyll a	mg/L	0.0011 ± 0.000196	0.00111 ± 0.000189	0.00117 ± 0.000204	0.00127 ± 0.000216	0.00121 ± 0.000203	0.00108 ± 0.000156
Enterococci	cfu/100 mL	<10 ± 0 (below detection limit)	<10 ± 0 (below detection limit)	<10 ± 0 (below detection limit)	<10 ± 0 (below detection limit)	<10 ± 0 (below detection limit)	<10 ± 0 (below detection limit)

4.3 Long-term spatial pattern

Statistically significant differences between site groups were detected for dissolved reactive phosphorus and nitrate (Figure 4-1)

- Nitrate showed the clearest spatial pattern, with concentrations generally higher and more variable at the inner effects sites located 200m from the outfall compared with the outer effects and reference sites. This suggests that nitrate enrichment is most evident close to the outfall and decreases with distance.
- Dissolved reactive phosphorus showed a weaker pattern, with slightly higher concentrations and greater variability at the inner sites, although concentrations overlapped substantially among site groups.
- Overall, the results indicate a localised nutrient increase near the outfall, particularly for nitrate.

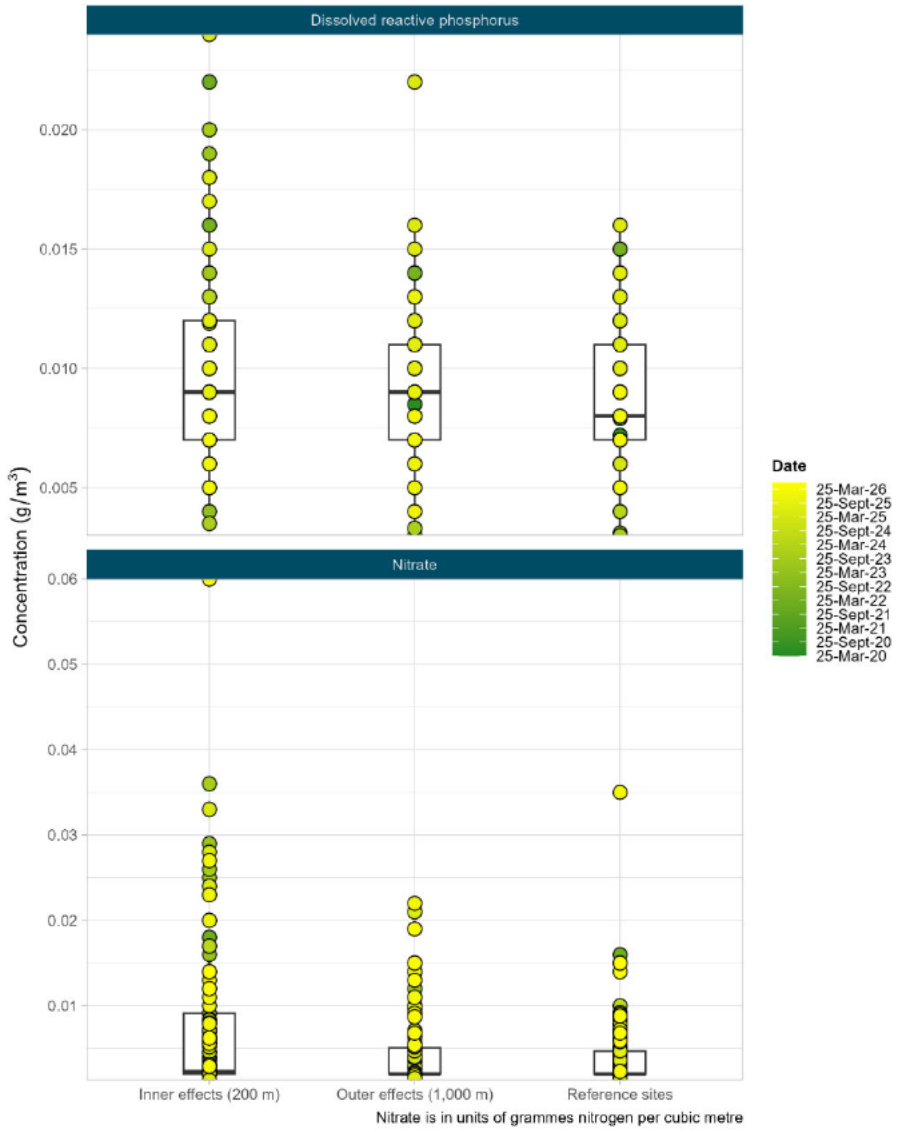

Figure 4-1 Parameters with statistically significant differences (dissolved reactive phosphorus and nitrate) between sites for 2020-2026

4.4 Shellfish

4.4.1 Microbiology

Table 4-4 shows the results for the 2025-2026 shellfish testing (12 December 2025 for most sites and 18 December 2025 for Tiritiri Matangi). This table shows that bacterial levels were lower in shellfish at the sites nearest to the outfall (Huaroa Point and Whangaparaoa Head) than in other places. Concentrations of *E. Coli* in shellfish were lower than limits specified for safe human consumption (MPI, 2024[2]).

Table 4-4 Bacterial and virus data for shellfish samples collected December 2025.

Parameter	Army Bay	Huaroa Point	Te Haruhi Bay	Tiritiri Matangi	Whangaparaoa Head
Water samples					
Escherichia coli	1.6	1.6	<1.6	<1.6	<1.6
Faecal coliforms	3.3	4.9	<1.6	1.6	<1.6
Enterococci	<1.6	4.9	<1.6	<1.6	<1.6
Shellfish samples					
Escherichia coli	20.0 (20.0-130.0)	18.0 (18.0-45.0)	20.0 (18.0-170.0)	45.0 (18.0-93.0)	18.0 (18.0-20.0)
Faecal coliforms	20.0 (20.0-170.0)	18.0 (18.0-45.0)	20.0 (18.0-170.0)	78.0 (20.0-110.0)	18.0 (18.0-20.0)
Adenoviruses	<4.0	<4.0	<4.0	<4.0	<4.0
Enteroviruses*	<4.0	<4.0	<4.0	<4.0	<4.0

Notes: All units MPN/100 g except * pfu/100 g.

4.4.2 Heavy metals

Table 4-5 shows heavy metals in the shellfish. These results are in wet weight concentrations allowing comparison to food safety guidelines weight (Stewart et al. 2013[4]). The results indicate that inorganic arsenic, cadmium, lead, and mercury concentrations were below FSANZ (2026[5]) guidelines at all sites. Consequently, Watercare does not need to carry out any further actions this monitoring round.

Table 4-5 Heavy metal data from shellfish samples collected 19-20 December 2025

Description	Arsenic (Total)	Arsenic (Inorganic)	Cadmium	Lead	Mercury
FSANZ (2026) limit	–	**1**	**2**	**2**	**0.5 (1.5)**
Army Bay	3.0 (3.2)	0.3 (0.32)	1.0 (1.1)	0.03 (0.03)	0.02 (0.02)
Huraoa Point	2.8 (3.2)	0.3 (0.3)	1.1 (1.3)	0.03 (0.04)	0.02 (0.02)
Te Haruhi	2.9 (3.1)	0.3 (0.3)	1.3 (1.3)	0.04 (0.04)	0.02 (0.03)
Whangaparaoa Head	3.2 (4.2)	0.3 (0.4)	1.1 (1.2)	0.04 (0.07)	0.03 (0.03)

[2]Ministry for Primary Industries (MPI) (2024) Animal Products Notice: Regulated Control Scheme - Bivalve Molluscan Shellfish for Human Consumption. Animal products notice. https://www.mpi.govt.nz/dmsdocument/30282-animal-products-notice-regulated-control-scheme-bivalve-molluscan-shellfish-for-human-consumption-2018

[4] Stewart, M., Gadd, J., Ballantine, D and Olsen, G (2013). Shellfish contaminant monitoring programme: status and trends analysis 1987-2011. Prepared by NIWA for Auckland Council. Auckland Council technical report, TR2013/054

[5] https://www.foodstandards.gov.au/food-standards-code/legislation

Tiritiri Matangi	3.3 (3.7)	0.3 (0.4)	1.6 (1.9)	0.04 (0.04)	0.02 (0.02)

Notes: All units are mg/kg wet weight. Data are mean values with the maximum next to them —n=5 for all sites. FSANZ Schedule 19 limits for molluscs/bivalve shellfish: inorganic arsenic 1 mg/kg, cadmium 2 mg/kg, lead 2 mg/kg, mercury 0.5 mg/kg (mean) and 1.5 mg/kg (max). No separate FSANZ limit for total arsenic is specified for molluscs.

Further analysis of wet weight concentrations using an ANOVA method (Table 4-6) indicated significant differences ($p<0.05$) between sites for cadmium, lead, and mercury.

Table 4-6 ANOVA test results on metal wet weight concentrations for 2025-2026 period

Metal	Test	F value	P value	Interpretation
Arsenic	ANOVA	1.622012296	0.207752822	No significant difference between sites
Cadmium	ANOVA	15.25851631	7.15599E-06	Significant difference between sites
Lead	ANOVA	3.095513802	0.038961865	Significant difference between sites
Mercury	ANOVA	7.23667146	0.000896998	Significant difference between sites

Corrected wet-weight concentrations of cadmium, lead and mercury were then compared among the five shellfish monitoring locations: Huaroa Point, Whangaparāoa Head, Army Bay, Te Haruhi Bay and Tiritiri Matangi Island (Figure 4-2). Huaroa Point and Whangaparāoa Head were grouped as the locations closest to the outfall, while Army Bay and Te Haruhi Bay were treated as other nearby mainland sites and Tiritiri Matangi Island as an offshore comparison site.

Cadmium and mercury showed statistically significant differences among locations and remained significant after Bonferroni correction. Lead showed a statistically significant raw ANOVA result, but this did not remain significant after multiple-comparison correction, so the lead result should be interpreted cautiously.

Cadmium concentrations were highest at Tiritiri Matangi Island, with a mean of 1.64 mg/kg wet weight, compared with 1.11 mg/kg at Huaroa Point and 1.08 mg/kg at Whangaparāoa Head. Tukey post-hoc testing showed that Tiritiri Matangi Island was significantly higher than Huaroa Point, Whangaparāoa Head, Army Bay and Te Haruhi Bay.

Mercury concentrations were highest at Whangaparāoa Head, with a mean of 0.026 mg/kg wet weight, compared with 0.020 mg/kg at Huaroa Point. Planned comparisons showed that Whangaparāoa Head was significantly higher than Huaroa Point.

There was no significant difference in arsenic among shellfish locations, and Huaroa Point was not significantly higher than the other sites for arsenic, cadmium, lead or mercury.

Overall, the corrected wet-weight results do not indicate a consistent pattern of metal concentrations being highest at Huaroa Point. Instead, the main findings are elevated cadmium at Tiritiri Matangi Island and elevated mercury at Whangaparāoa Head. This suggests that the observed metal patterns are unlikely to be explained solely by proximity to the Army Bay outfall and may reflect broader coastal or site-specific influences.

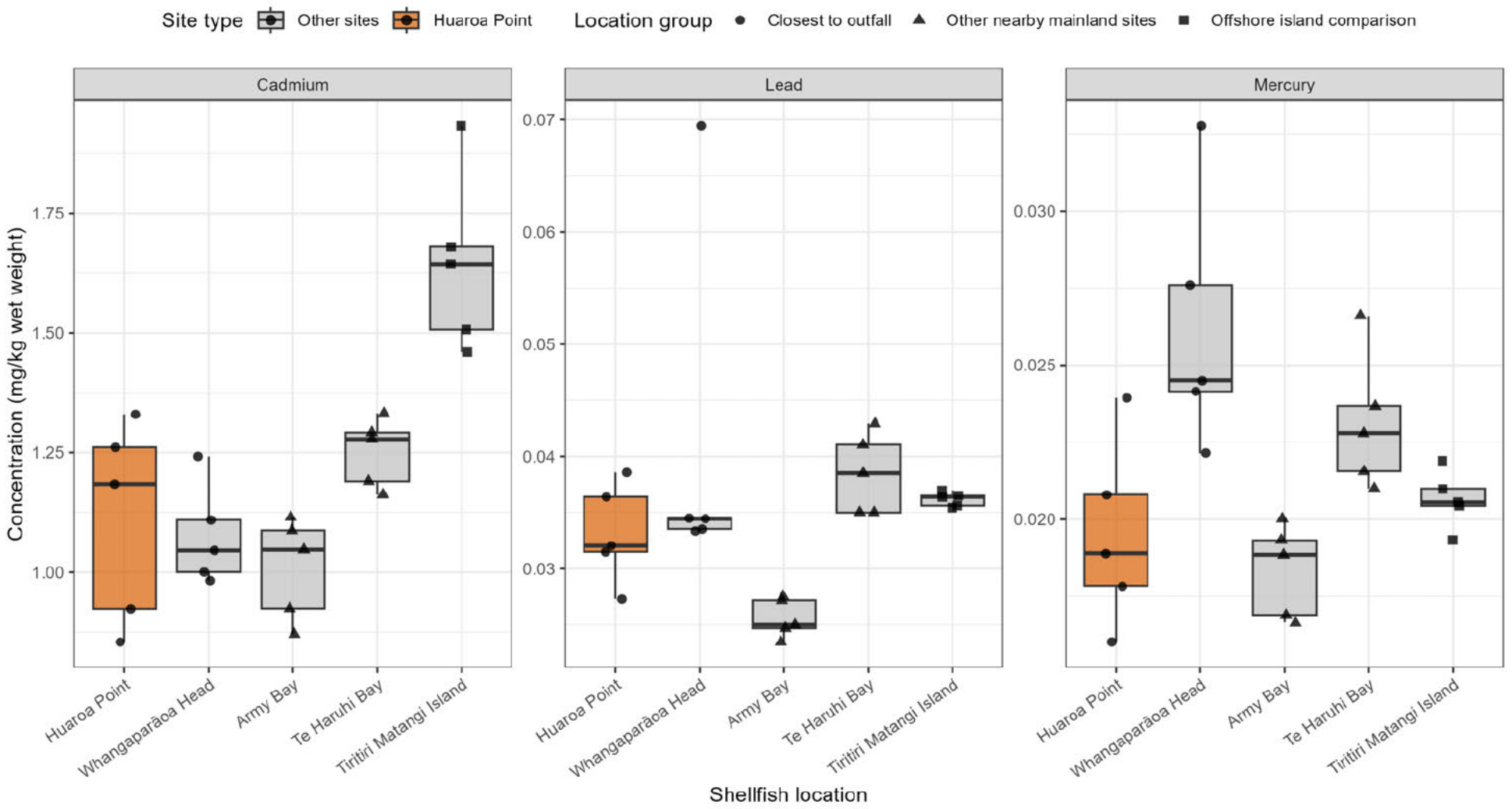

Figure 4-2 corrected wet-weight concentrations of cadmium, lead and mercury by shellfish location for the 2025-2026 period

Conclusion

Water quality

- Treated effluent quality met all consent limits. Results were generally lower that for the last reporting period
- Water quality results were generally similar spatially (across the transect) but varied temporally.
- Mixed effect modelling indicated a statistically significant site effect for pH, which was identified as a significant difference between N1000 and S2000.
- Seasonal analysis conducted for winter nutrient concentrations and summer chlorophyll-a concentrations also showed no significant difference between sites.

Long-term water quality

- Except for dissolved reactive phosphorus and nitrate, there were no statistically significant differences between sites for any water quality parameters.
- For both parameters, concentrations were higher closer to the outfall than at the reference sites.
- There was no evidence these differences were ecologically significant.
- Concentrations of *Enterococci spp.* were consistently below laboratory limits of detection.

Shellfish quality

- Concentrations of bacterial indicators were lowest in shellfish collected from the two sites closest to the outfall, and highest at Tiritiri Matangi.
- Viruses were below laboratory limits of detection in all samples
- Arsenic, cadmium, lead, and mercury concentrations were below FSANZ (2026) guidelines in all shellfish replicates, irrespective of location
- Spatial comparisons between shellfish metal results showed elevated cadmium at Tiritiri Matangi Island and elevated mercury at Whangaparāoa Head. This suggested that the observed metal patterns were unlikely to be explained solely by proximity to the Army Bay outfall and may reflect broader coastal or site-specific influences.

Appendix A. Data sources

Table 0-1 Download location of environmental monitoring data used in this report

Category	Parameter	Source platform	Tag/ID
Discharge flow	Discharge volumes and flow rates	Pi DataLink	DTARB_48_FIT_100_PV
Discharge quality	Physicochemical, nutrients, bacteria indicators, heavy metals	Labware ID	WSL_AB_STP_PUV_EFF_C DTARB-Field Data
Receiving water quality	Ammonia, cBOD5, Chlorophyll A, Conductivity, DO, Filtered Phosphorus, Enterococci, Nitrate, Nitrite, Salinity, Temperature, Total Nitrogen, TP, TSS, Turbidity, Volatile Solids	Labware	WSL_AB_ENV_N200 WSL_AB_ENV_N1000 WSL_AB_ENV_N2000 WSL_AB_ENV_S200 WSL_AB_ENV_S1000 WSL_AB_ENV_S2000
Shellfish quality		Labware	WSL_AB_STP_TI_SAL WSL_AB_STP_TI_SH_1 WSL_AB_STP_TI_SH_2 WSL_AB_STP_TI_SH_3 WSL_AB_STP_TI_SH_4 WSL_AB_STP_TI_SH_5 WSL_AB_STP_TI_SH_C WSL_AB_STP_HU_SH_SAL WSL_AB_STP_HU_SH_A WSL_AB_STP_HU_SH_B WSL_AB_STP_HU_SH_C WSL_AB_STP_HU_SH_D WSL_AB_STP_HU_SH_E WSL_AB_STP_HU_SH_CO WSL_AB_STP_WH_SH_SAL WSL_AB_STP_WH_SH_A WSL_AB_STP_WH_SH_B WSL_AB_STP_WH_SH_C WSL_AB_STP_WH_SH_D WSL_AB_STP_WH_SH_E WSL_AB_STP_WH_SH_CO WSL_AB_STP_TE_SAL WSL_AB_STP_TE_SH_A

			WSL_AB_STP_TE_SH_B WSL_AB_STP_TE_SH_C WSL_AB_STP_TE_SH_D WSL_AB_STP_TE_SH_E WSL_AB_STP_AB_SAL WSL_AB_STP_AB_SH_A WSL_AB_STP_AB_SH_B WSL_AB_STP_AB_SH_C WSL_AB_STP_AB_SH_D WSL_AB_STP_AB_SH_E WSL_AB_STP_AB_SH_CO

Appendix B. Receiving water quality

Table 0-2 Raw water quality results for S2000 (2025-2026)

Date	Ammonia (mg/L)	cBOD5 (mg/L)	Chlorophyll A (mg/L)	Conductivity (µS/cm)	DO (mg/L)	DRP (mg P/L)	Filtered Phosphorus (mg P/L)	Enterococci (MPN/100mL)	Nitrate (mg N/L)	Nitrite (mg N/L)	pH	Salinity (g/L)	Temperature (°C)	Total Nitrogen (g N/L)	TP (g P/L)	TSS (mg/L)	Turbidity (mg/L)	Volatile Solids (mg/L)
25/07/2025	0.005	0.5	0.0007	50000	8.8	0.013		<10	0.0014	0.001	7.8	33.2	13.9	0.092	0.021	54.4	0.45	9.4
11/08/2025	0.011	0.5	0.0023	50000	8.6	0.014		<10	0.0036	0.001	7.9	32.4	13.2	0.1	0.015	41.2	1	9
11/09/2025	0.005	0.5	0.00086	50000	8.1	0.007		<10	0.0072	0.001	8	37	14.5	0.055	0.008	52.4	0.3	10
7/10/2025	0.015	0.5	0.0006	44000	7.9	0.008		<10	0.0079	0.001	8.1	35.2	15.7	0.077	0.008	55.4	0.55	12
19/11/2025	0.005	0.62	0.0016	54000	7.5	0.005		<10	0.0067	0.0034	8	35.5	19.1	0.12	0.009	11	0.6	4.4
18/12/2025	0.005	0.5	0.0006	55000	7.1	0.007		<10	0.0069	0.001	8.4	36.2	20.4	0.066	0.008	27.4	1.2	10
27/01/2026	0.005	0.5	0.0008	56000	6.9	0.009		<10	0.015	0.0026	8	37.2	20.6	0.075	0.01	45.4	0.45	7.6
17/02/2026	0.005	0.5	0.0016	54000	7	0.008		<10	0.035	0.001	8.1	36	21.9	0.089	0.008	47.8	0.7	11
18/03/2026	0.005	0.5	0.0006	51000	7.3		0.0098	<10	0.0058	0.001	8.1	33.7	20.4	0.078	0.021	37.4	0.75	10
21/04/2026	0.005	0.5	0.0011	52000	7.2		0.018	<10	0.0088	0.0016	8.1	34.6	19.6	0.075	0.024	41	2.1	8.2
18/05/2026	0.005	0.5	0.0014	52000	7.7		0.012	<10	0.0068	0.001	8.1	34	17.4	0.074	0.025	34.8	1.5	11
17/06/2026	0.005	0.5	0.00075	53000	7.9		0.011	<10	0.015	0.001	8.2	35.2	15.8	0.083	0.02	32	1.3	7.2

Table 0-3 Raw water quality results for S200 (2025-2026)

Date	Ammonia (mg/L)	cBOD5 (mg/L)	Chlorophyll A (mg/L)	Conductivity (µS/cm)	DO (mg/L)	DRP (mg P/L)	Filtered Phosphorus (mg P/L)	Enterococci (MPN/100mL)	Nitrate (mg N/L)	Nitrite (mg N/L)	pH	Salinity (g/L)	Temperature (°C)	Total Nitrogen (g N/L)	TP (g P/L)	TSS (mg/L)	Turbidity (mg/L)	Volatile Solids (mg/L)
25/07/2025	0.005	0.5	0.00068	50000	8.7	0.017		<10	0.00	0.001	8.2	33.5	14.2	0.087	0.016	21	0.45	5.8
11/08/2025	0.005	0.5	0.0024	50000	8.5	0.012		<10	0.01	0.001	8.1	32.7	13.3	0.08	0.013	96.6	0.5	17
11/09/2025	0.027	0.5	0.00071	50000	8.1	0.009		<10	0.01	0.001	8.1	36.9	14.5	0.18	0.034	39	0.25	6.8
7/10/2025	0.005	0.5	0.0006	44000	7.9	0.008		<10	0.01	0.001	8.1	35.2	15.6	0.066	0.01	48	0.3	8.4
19/11/2025	0.0051	0.62	0.0006	54000	7.5	0.01		<10	0.01	0.0011	8.1	35.5	19.2	0.12	0.013	33.6	0.45	6.6
18/12/2025	0.005	0.5	0.00092	55000	7.2	0.007		<10	0.02	0.001	8.4	36.2	20.5	0.094	0.011	46	0.3	14
27/01/2026	0.005	0.5	0.0006	56000	7.1	0.006		<10	0.03	0.001	8.1	37.2	20.9	0.063	0.009	41.8	0.5	6.8
17/02/2026	0.005	0.5	0.00086	54000	7	0.007		<10	0.01	0.001	8.2	36	21.9	0.07	0.008	43.6	0.45	10
18/03/2026	0.005	0.5	0.0016	51000	7.4		0.0096	<10	0.01	0.001	8.1	33.7	20.5	0.097	0.02	34.8	0.5	9.8
21/04/2026	0.005	0.5	0.0024	52000	7.2		0.0097	<10	0.01	0.0016	8.1	34.5	19.6	0.08	0.035	31.8	1	6.6
18/05/2026	0.005	0.5	0.0023	52000	7.7		0.027	<10	0.06	0.0028	8.2	34.1	17.7	0.14	0.04	52.2	0.8	10
17/06/2026	0.005	0.5	0.0016	54000	7.8		0.011	<10	0.01	0.0014	8.2	35.3	16.1	0.09	0.018	31.2	0.8	6.6

Table 0-4 Raw water quality results for S1000 (2025-2026)

Date	Ammonia (mg/L)	cBOD5 (mg/L)	Chlorophyll A (mg/L)	Conductivity (µS/cm)	DO (mg/L)	DRP (mg P/L)	Filtered Phosphorus (mg P/L)	Enterococci (MPN/100mL)	Nitrate (mg N/L)	Nitrite (mg N/L)	pH	Salinity (g/L)	Temperature (°C)	Total Nitrogen (g N/L)	TP (g P/L)	TSS (mg/L)	Turbidity (mg/L)	Volatile Solids (mg/L)
25/07/2025	0.005	0.51	0.00087	50000	8.8	0.012		<10	0.00	0.001	8	33.3	14	0.088	0.017	40	0.55	6.8
11/08/2025	0.005	0.5	0.0029	50000	8.6	0.011		<10	0.01	0.001	8	32.4	13.1	0.078	0.013	38.2	1	9.8
11/09/2025	0.005	0.55	0.0014	50000	7.9	0.01		<10	0.01	0.001	8	37.1	14.5	0.071	0.008	84	0.45	15
7/10/2025	0.005	0.5	0.00083	44000	7.9	0.009		<10	0.01	0.001	8.1	35.2	15.7	0.078	0.01	46	0.5	10
19/11/2025	0.005	0.5	0.00074	54000	7.6	0.006		<10	0.01	0.001	8.1	35.6	19.1	0.12	0.01	46.6	0.35	11
18/12/2025	0.005	0.5	0.0006	55000	7.3	0.005		<10	0.01	0.001	8.4	36.3	20.6	0.079	0.008	44.8	0.3	13
27/01/2026	0.005	0.5	0.0012	56000	7	0.008		<10	0.01	0.0024	8	37.2	20.7	0.065	0.01	40.4	0.5	6.4
17/02/2026	0.005	0.5	0.0006	54000	7	0.008		<10	0.01	0.001	8.1	36	21.9	0.088	0.009	45.8	0.7	11
18/03/2026	0.005	0.5	0.0012	51000	7.2		0.01	<10	0.01	0.001	8.1	33.7	20.3	0.075	0.021	31.6	1	13
21/04/2026	0.005	0.5	0.00094	52000	7.3		0.01	<10	0.01	0.0014	8.1	34.6	19.5	0.073	0.022	48	2.3	9
18/05/2026	0.005	0.5	0.0023	52000	7.7		0.012	<10	0.01	0.001	8.1	34.1	17.6	0.089	0.025	48.2	1.4	11
17/06/2026	0.005	0.5	0.00096	53000	7.9		0.01	<10	0.02	0.001	8.2	35.2	16	0.078	0.02	29	1	6.8

Table 0-5 Raw water quality results for N2000 (2025-2026)

Date	Ammonia (mg/L)	cBOD5 (mg/L)	Chlorophyll A (mg/L)	Conductivity (µS/cm)	DO (mg/L)	DRP (mg P/L)	Filtered Phosphorus (mg P/L)	Enterococci (MPN/100mL)	Nitrate (mg N/L)	Nitrite (mg N/L)	pH	Salinity (g/L)	Temperature (°C)	Total Nitrogen (g N/L)	TP (g P/L)	TSS (mg/L)	Turbidity (mg/L)	Volatile Solids (mg/L)
25/07/2025	0.005	0.5	0.0006	50000	8.7	0.011		<10	0.00	0.001	8.3	33.7	14.3	0.091	0.015	11	0.35	3.8
11/08/2025	0.0085	0.5	0.0023	50000	8.5	0.01		<10	0.00	0.001	8.2	33	13.7	0.08	0.013	42.6	0.5	11
11/09/2025	0.005	0.55	0.0014	50000	8.2	0.008		<10	0.00	0.001	8.1	37	14.5	0.062	0.007	45.2	0.25	9.2
7/10/2025	0.005	0.5	0.0006	44000	8	0.008		<10	0.01	0.001	8.1	35.2	15.7	0.056	0.009	49.6	0.25	11
19/11/2025	0.005	0.5	0.0008	54000	7.6	0.005		<10	0.01	0.001	8.2	35.6	19.3	0.12	0.01	43.4	0.25	9.2
18/12/2025	0.005	0.5	0.0006	55000	7.3	0.008		<10	0.01	0.001	8.1	36.2	20.6	0.087	0.011	34.6	0.3	11
27/01/2026	0.005	0.5	0.0006	56000	7.3	0.005		<10	0.02	0.002	8.1	37.1	20.9	0.071	0.007	27.8	0.3	5
17/02/2026	0.005	0.5	0.00062	54000	7.1	0.007		<10	0.01	0.001	8.2	36	21.9	0.077	0.008	50.8	0.3	12
18/03/2026	0.005	0.5	0.0014	51000	7.4		0.0077	<10	0.00	0.001	8.1	33.8	20.4	0.067	0.017	34.2	0.35	3.8
21/04/2026	0.005	0.5	0.0025	52000	7.4		0.0089	<10	0.01	0.0013	8.1	34.6	19.8	0.053	0.018	42.4	0.6	6.8
18/05/2026	0.005	0.5	0.0011	52000	7.8		0.01	<10	0.01	0.001	8.3	34.3	17.5	0.065	0.019	55.4	0.4	11
17/06/2026	0.005	0.5	0.00068	53000	7.9		0.011	<10	0.01	0.0016	8.1	35.2	16.2	0.074	0.018	32.2	0.6	7.2

Table 0-6 Raw water quality results for N200 (2025-2026)

Date	Ammonia (mg/L)	cBOD5 (mg/L)	Chlorophyll A (mg/L)	Conductivity (µS/cm)	DO (mg/L)	DRP (mg P/L)	Filtered Phosphorus (mg P/L)	Enterococci (MPN/100mL)	Nitrate (mg N/L)	Nitrite (mg N/L)	pH	Salinity (g/L)	Temperature (°C)	Total Nitrogen (g N/L)	TP (g P/L)	TSS (mg/L)	Turbidity (mg/L)	Volatile Solids (mg/L)
25/07/2025	0.005	0.5	0.001	50000	8.7	0.012		<10	0.00	0.001	8.2	33.4	14.2	0.094	0.017	35.4	0.45	7.2
11/08/2025	0.005	0.5	0.0025	50000	8.5	0.011		<10	0.01	0.0011	8.1	32.8	13.4	0.071	0.012	46.4	0.55	9.6
11/09/2025	0.005	0.5	0.0006	50000	8.2	0.007		<10	0.01	0.001	8.1	37	14.5	0.051	0.008	46.6	0.25	15
7/10/2025	0.011	0.5	0.0006	44000	7.9	0.007		<10	0.01	0.001	8.1	35.5	15.6	0.065	0.007	42	0.3	11
19/11/2025	0.005	0.5	0.00069	54000	7.5	0.007		<10	0.01	0.001	8.1	35.6	19.1	0.13	0.022	40.8	0.25	9.2
18/12/2025	0.005	0.5	0.00084	550	7.3	0.006		<10	0.02	0.001	8.4	36.2	20.6	0.11	0.01	40.8	0.3	13
27/01/2026	0.005	0.5	0.0006	56000	7.1	0.005		<10	0.01	0.0025	8.1	37.2	20.9	0.066	0.009	38.8	0.5	8.2
17/02/2026	0.005	0.5	0.00099	54000	7	0.008		<10	0.01	0.001	8.2	36	22	0.077	0.009	50	0.65	17
18/03/2026	0.005	0.5	0.0013	51000	7.4		0.0091	<10	0.00	0.001	8.1	33.8	20.5	0.084	0.019	35	0.5	10
21/04/2026	0.005	0.67	0.0024	52000	7.2		0.01	<10	0.01	0.0016	8.1	34.5	19.6	0.083	0.023	43.2	1	7.8
18/05/2026	0.005	0.94	0.0019	52000	7.7		0.012	<10	0.01	0.0011	8.2	34.2	17.7	0.13	0.032	42.4	0.65	10
17/06/2026	0.005	0.5	0.00064	54000	7.9		0.011	<10	0.01	0.0014	8.2	35.3	16.2	0.04	0.021	5.4	0.95	1

Table 0-7 Raw water quality results for N1000 (2025-2026)

Date	Ammonia (mg/L)	cBOD5 (mg/L)	Chlorophyll A (mg/L)	Conductivity (µS/cm)	DO (mg/L)	DRP (mg P/L)	Filtered Phosphorus (mg P/L)	Enterococci (MPN/100mL)	Nitrate (mg N/L)	Nitrite (mg N/L)	pH	Salinity (g/L)	Temperature (°C)	Total Nitrogen (g N/L)	TP (g P/L)	TSS (mg/L)	Turbidity (mg/L)	Volatile Solids (mg/L)
25/07/2025	0.005	0.5	0.0006	50000	8.7	0.011		<10	0.00	0.001	8.3	33.8	14.4	0.094	0.016	24.4	0.3	6.6
11/08/2025	0.005	0.5	0.0023	50000	8.5	0.011		<10	0.00	0.001	8.2	32.8	13.4	0.064	0.012	44.4	0.5	11
11/09/2025	0.005	0.5	0.0006	50000	8.2	0.008		<10	0.01	0.001	8.1	36.9	14.6	0.07	0.007	63.8	0.25	12
7/10/2025	0.005	0.5	0.0006	44000	7.1	0.008		<10	0.01	0.001	8.1	35.2	15.6	0.062	0.009	38.8	0.4	9.4
19/11/2025	0.015	0.5	0.0006	54000	7.5	0.013		<10	0.02	0.0026	8.1	35.5	19	0.14	0.02	45.2	0.45	9
18/12/2025	0.005	0.5	0.0006	55000	7.3	0.004		<10	0.01	0.001	8.3	36.3	20.6	0.08	0.009	22.2	0.35	12
27/01/2026	0.005	0.5	0.0006	56000	7.2	0.008		<10	0.02	0.001	8.1	37.2	20.9	0.06	0.008	37.8	0.45	8.4
17/02/2026	0.005	0.5	0.00086	54000	7	0.007		<10	0.01	0.001	8.2	36	21.9	0.096	0.008	49.4	0.5	11
18/03/2026	0.005	0.5	0.0012	51000	7.4		0.0091	<10	0.01	0.001	8.1	33.8	20.5	0.078	0.02	45.4	0.5	12
21/04/2026	0.005	0.7	0.0015	52000	7.3		0.01	<10	0.01	0.0013	8.1	34.6	19.6	0.061	0.02	46.4	1.2	8.2
18/05/2026	0.005	0.5	0.0017	52000	7.8		0.014	<10	0.02	0.0014	8.2	34.2	17.5	0.095	0.022	29.4	0.6	7.6
17/06/2026	0.005	0.5	0.0022	53000	7.9		0.011	<10	0.01	0.0014	8.2	35.3	16.2	0.078	0.018	36.4	0.6	7.8

Appendix C. Shellfish results

Sample location/ replicate	Biomatter % Moisture	Biomatter % Solids	Adenoviruses (MPN/100 g)	Enteroviruses (pfu/100 g)	Enterococci (MPN/100 g)	*E. coli* (MPN/100 g)	Faecal coliforms (MPN/100 g)	Arsenic (Dry Weight)	Cadmium (Dry Weight)	Lead (Dry Weight)	Mercury (Dry Weight)
Army Bay Saline					1.6	1.6	3.3				
Army Bay Shellfish - 1	88.1	11.9				20	20	22	8.8	0.21	0.14
Army Bay Shellfish - 2	86.2	13.8				20	20	23	6.7	0.17	0.14
Army Bay Shellfish - 3	85.5	14.5				20	20	22	7.5	0.19	0.13
Army Bay Shellfish - 4	87	13				130	170	22	6.7	0.19	0.13
Army Bay Shellfish - 5	85.7	14.3				45	45	22	7.8	0.19	0.14
Army Bay Shellfish - Composite			4	4							
Huaroa Point Saline					4.9	1.6	4.9				
Huaroa Point Shellfish - 1	87	13				18	18	24	9.7	0.28	0.16

Huaroa Point Shellfish - 2	89.5	10.5				18	18	23	8.8	0.26	0.17
Huaroa Point Shellfish - 3	86.7	13.3				18	18	23	10	0.29	0.18
Huaroa Point Shellfish - 4	87.4	12.6				18	18	25	9.4	0.25	0.15
Huaroa Point Shellfish - 5	91.1	8.9				45	45	26	9.6	0.36	0.18
Huaroa Point Shellfish - Composite			4	4							
Te Haruhi Bay SW Headland Saline					1.6	1.6	1.6				
Te Haruhi Bay SW Headland Shellfish - 1	84.8	15.2				18	18	20	8.5	0.27	0.15
Te Haruhi Bay SW Headland	86	14				78	78	20	8.3	0.25	0.15

Shellfish - 2											
Te Haruhi Bay SW Headland Shellfish - 3	86	14				18	18	19	8.5	0.25	0.19
Te Haruhi Bay SW Headland Shellfish - 4	85.2	14.8				170	170	19	9	0.29	0.16
Te Haruhi Bay SW Headland Shellfish - 5	84.6	15.4				20	20	20	8.3	0.25	0.14
Te Haruhi Bay SW Headland Shellfish - Composite			4	4							
Tiritiri Matangi eastern shore saline					1.6	1.6	1.6				
Tiritiri Matangi eastern shore	86.3	13.7				93	93	22	11	0.26	0.15

Shellfish - 1											
Tiritiri Matangi eastern shore Shellfish - 2	86.3	13.7				78	110	24	12	0.27	0.16
Tiritiri Matangi eastern shore Shellfish - 3	86	14				18	20	23	12	0.26	0.15
Tiritiri Matangi eastern shore Shellfish - 4	83.9	16.1				40	68	23	12	0.22	0.12
Tiritiri Matangi eastern shore Shellfish - 5	85.4	14.6				45	78	22	10	0.25	0.14
Tiritiri Matangi eastern shore Shellfish - Composite			4	4							

Whangaparaoa Head Saline					1.6	1.6	1.6				
Whangaparaoa Head Shellfish - 1	87.7	12.3				18	18	22	8.5	0.28	0.18
Whangaparaoa Head Shellfish - 2	87.1	12.9				18	18	24	8.6	0.26	0.19
Whangaparaoa Head Shellfish - 3	88.5	11.5				18	18	24	8.7	0.29	0.21
Whangaparaoa Head Shellfish - 4	86.2	13.8				18	18	25	9	0.25	0.2
Whangaparaoa Head Shellfish - 5	86.9	13.1				20	20	32	7.5	0.53	0.25
Whangaparaoa Head Shellfish - Composite			4	4							