

Streams median satisfaction score over one year for each category

	Avana	Paringaru	Akapuao	Totokoitu	Rutaki	Betela	North Airport Drain	Avatiu	
NUTRIENTS	2007	37	33	30	37	37	27	40	37
	2008	37	33	30	37	50	37	63	37
	2009	33	33	30	30	30	27	50	37
	2010	30	27	27	27	37	37	50	37
	2011	37	30	47	20	50	37	63	30
WATER CLARITY	2007	90	90	30	90	90	70	70	70
	2008	90	70	30	70	90	70	50	70
	2009	90	70	30	90	70	70	50	70
	2010	70	70	50	90	90	70	50	70
	2011	50	70	50	90	90	50	50	50
BACTERIA	2007	0	0	0	0	0	0	70	0
	2008	0	0	0	0	0	0	50	0
	2009	0	0	0	0	0	0	30	0
	2010	0	0	0	0	0	0	50	0
	2011	0	0	0	0	0	0	70	0
DISSOLVED OXYGEN	2007	-	-	-	-	-	-	-	-
	2008	90	30	10	70	90	50	90	70
	2009	90	90	10	50	10	30	90	50
	2010	70	30	0	50	10	30	90	50
	2011	50	30	0	50	30	10	70	30

Satisfaction scale	
A	90% PASS
B	70% PASS
C	50% PASS
D	30% FAIL
E	10% FAIL
F	0% FAIL
-	No Data



Ministry of Marine Resources
GOVERNMENT OF THE COOK ISLANDS

Trends in Rarotonga streams' water quality from 2007 to 2011

The Water Quality Monitoring Programme in Rarotonga

The Ministry of Marine Resources (MMR) in collaboration with the National Environment Services, the Ministry of Infrastructure and Planning, and the Ministry of Health, undertakes the monitoring of stream, lagoon and groundwater in the Cook Islands. The programme is funded by the European Union, NZAid, Ausaid, and the Integrated Water Resources Management (IWRM).

The objective of the monitoring program is to provide baseline data to:

- assess the health of the lagoon,
- provide information to make good management decisions.

The monitoring program, which was initiated in 2004, has been audited by NIWA (National Institute of Water and Atmospheric Research New Zealand) since 2007. Laboratory and sampling

regime protocols are subject to regular developments along with continuous staff training to ensure the production of sound results. As of today, 30 sites are monitored around Rarotonga, and also sites in Aitutaki and Manihiki.

Evolution of Rarotonga water quality results from 2007 to 2011

This document aims to report the evolution of water quality in Rarotonga over the previous 5 years. Satisfaction scores were calculated for bacterial counts, nutrient levels, water clarity, and for streams, dissolved oxygen (DO), based upon accepted international standards for human and coral reef health. For each parameter, levels which were at or below the maximum accepted levels to be considered safe for human and coral reef health were considered to 'PASS'. Levels which exceeded the maximum accepted levels were considered to 'FAIL'. All raw measurements were also

converted onto a 0-100% Satisfaction Scale based upon degree of deviation from international standards. Levels significantly lower than maximum accepted standards were given high levels of satisfaction. Levels exceeding the maximum accepted standards were given a low degree of satisfaction score.

From a collaborative study with MMR in 2011, NIWA concluded that phosphorus levels (a nutrient) were naturally high in Rarotonga streams due the volcanic geology of the island. Thresholds and standard levels for phosphorus in streams were thus revised. The new thresholds allow MMR to better differentiate between natural and human-impacted phosphorus levels in streams and thus detect abnormal levels caused by pollution. Results from previous years were realigned with the new phosphorus standards.

These tables are designed to give an overview, rather than detail, of all monthly water quality tests. The figures shown represent the median of the results gained over each year. Satisfaction scores were calculated

based upon accepted international standards for human and coral reef health.

MMR now tests at an additional six stream sites around Rarotonga. These

new sites are not included here, but are shown on the annual report.

Further information can be found on www.mmr.gov.ck or contact d.solomona@mmr.gov.ck



Below are standards for all parameters and the satisfaction scale.

Stream Water Quality

Score for reports	Parameter	Units	Limit Categories						Reference
			A	B	C	D	E	F	
NUTRIENTS	NH4 (Ammonia)	µg/L	<2.5	≥2.5; <5	≥5; <10	≥10; <20	≥20; <40	≥40	ANZECC standard 10µg/l
	NO3 (Nitrate)	µg/L	<2.5	≥2.5; <5	≥5; <10	≥10; <20	≥20; <40	≥40	ANZECC standard 10µg/l
	DRP (Dissolved Reactive Phosphorous)	µg/L	<13.75	≥13.75; <27.5	≥27.5; <55	≥55; <110	≥110; <220	≥220	Recommendations made by NIWA from the Evaluation of DRP and TSS benchmarks (2011) standard 55µg/l
WATER CLARITY	TSS (Total Suspended Solids)	mg/L	<1.4	≥1.4; <2.8	≥2.8; <6	≥6; <12	≥12; <24	≥24	ANZECC trigger level is 2-15 mg/l
	DO (Dissolved Oxygen)	% of saturation	<40	≥40; <60	≥60; <80	≥80; <90	≥90; <95	≥95	80% of Hawaii Clean Water Branch
BACTERIA	Enterococci Bacteria	bacteria per 100 mL	<40	≥40; ≤100	≥101; ≤200	≥201; ≤350	≥351; ≤500	≥501	WHO guidelines

Reading these graphs

These graphs display the annual satisfaction levels for each parameter. Results in the shaded area indicate a pass.

For Example: Avatiu site, DO (Dissolved Oxygen) levels were at 50% satisfaction in 2009 and 30% satisfaction in 2011. DO results for 2009 passed but 2011 failed. A 50% (or better) satisfaction or pass, is shown in the shaded area.

Key

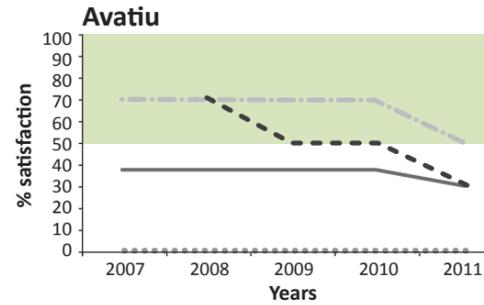
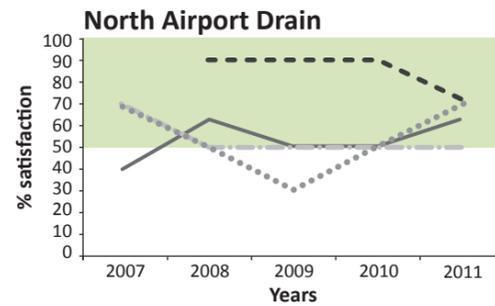
- Nutrients ————
 - Water clarity - - - - -
 - Bacteria ······
 - DO (Dissolved oxygen) - - - - -
- The green shaded area shows results that have reached 50% or better satisfaction and so pass

North Airport Drain: Water Clarity levels decreased from 70% to 50% satisfaction between 2007 and 2008, and were consistently at 50% since 2008. All years passed.

DO levels were consistently at 90% satisfaction and decreased to 70% in 2011. All years passed.

Nutrient levels varied between 27% to 37% satisfaction. All years failed

Bacterial levels were consistently at 0% satisfaction. All years failed.



Avatiu: Water Clarity levels were consistently at 70% satisfaction then decreased to 50% in 2011. All years passed.

DO levels consistently decreased from 70% to 30% between 2008 and 2011. Only year 2011 failed.

Nutrients levels varied between 30% to 37%. All years failed

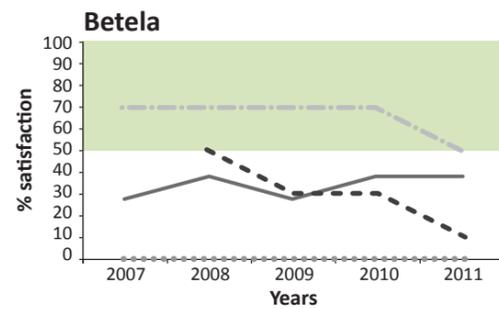
Bacterial levels were consistently at 0% satisfaction. All years failed.

Betela: Water Clarity levels were consistently at 70% of satisfaction and decreased to 50% satisfaction in 2011. All years passed.

DO levels consistently decreased from 50% to 10% between 2008 and 2011. Only year 2008 passed.

Nutrients levels varied between 27% to 37%. All years failed.

Bacterial levels were consistently at 0% satisfaction. All years failed.

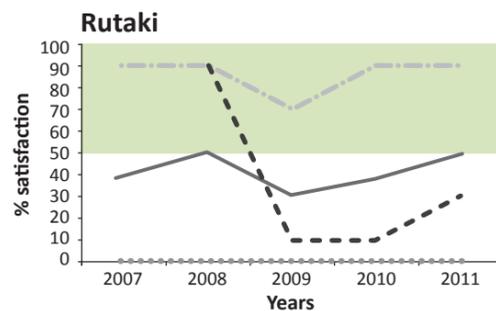


Rutaki: Water Clarity levels were consistent at 90% for all years except in 2009 they decreased from 90% to 70%. All years passed.

DO levels decreased from 90% to 10% between 2008 and 2009 then levels increased to 30% satisfaction in 2011. Only 2008 passed.

Nutrients levels varied between 30% to 50% satisfaction. Years 2008 and 2011 passed.

Bacterial levels were consistently at 0% satisfaction. All years failed.

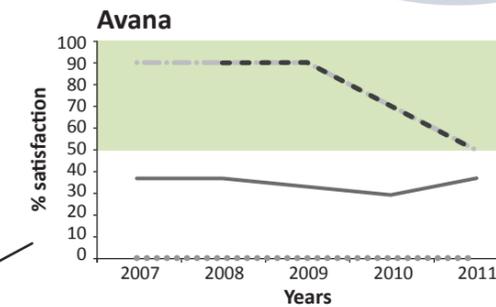
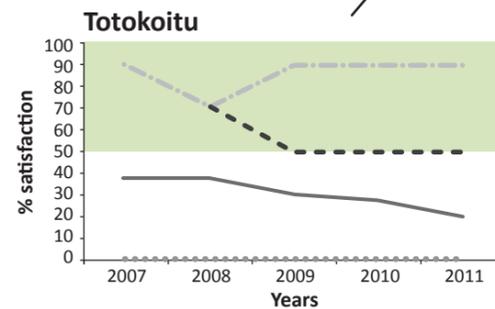


Totokoitu: Water Clarity levels decreased from 90% to 70% between 2007 and 2008, and were consistently at 90% since 2009. All years passed.

DO levels decreased between 2008 and 2009 from 70% to 50% satisfaction and were at 50% satisfaction since 2009. All years passed.

Nutrients levels consistently decreased from 35% to 20% between 2007 and 2011, and all years failed.

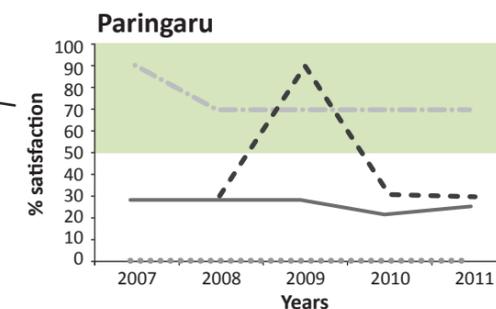
Bacterial levels were consistently at 0% satisfaction. All years failed.



Avana: Water Clarity and DO levels decreased from 90% to 50% between 2009 and 2011. All years passed.

Nutrients levels varied between 40% to 30%. All years failed.

Bacterial levels were consistently at 0% satisfaction. All years failed.

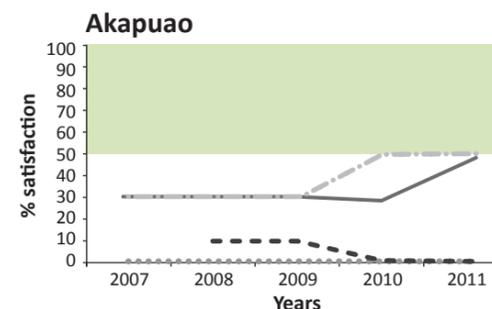


Paringaru: Water Clarity levels decreased between 2007 and 2008 from 90% to 70% satisfaction and were consistently at 70% satisfaction since 2008. All years passed.

DO levels were at 30% satisfaction in 2008, 2010 and 2011, and increased to 90% satisfaction in 2009. Only 2009 passed.

Nutrients levels varied between 27% to 33% and all years failed.

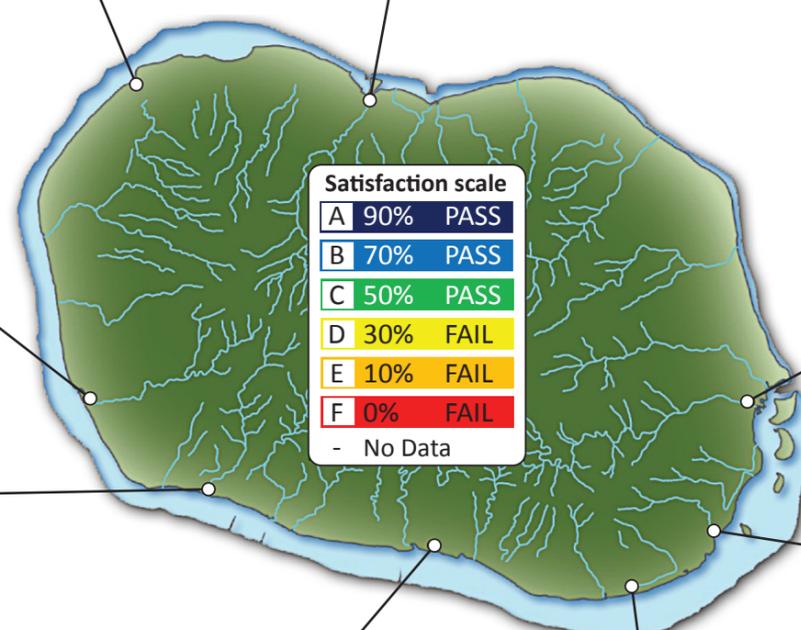
Bacterial levels were consistently at 0% satisfaction. All years failed.



Akapuao: All parameters were consistently below the 50% satisfaction level except for Water Clarity levels in 2010 and 2011 that were at 50% satisfaction.

All years failed for Nutrients, DO and Bacterial levels.

Only years 2010 and 2011 passed for Water Clarity.



Satisfaction scale		
A	90%	PASS
B	70%	PASS
C	50%	PASS
D	30%	FAIL
E	10%	FAIL
F	0%	FAIL
-	No Data	

