



## RAROTONGA WATER QUALITY REPORT APRIL 2025

### SUMMARY

Water samples were collected on Wednesday 30<sup>th</sup> April. Low to high tides were observed during sample collection. Halimeda algae was present at four lagoon sites between Muri Buoy and Totokoitu Station. Betela and Areiti were the only two streams flowing and samples collected. Remaining stream sites had seawater influence and stagnancy. High water clarity and presence of juvenile fish were observed at sampled streams. The table below provides a summary of the main parameters.

Lagoon Site	Site ID	Enterococci (MPN/100ml)	Total Suspended Solids (mg/L)	Dissolved Oxygen (%)
Pouara Rai	RAM03	<1	1.7	107
Avana Mudflats	RAM04	10	4.7	93
Paringaru	RAM05	135	6.8	100
Tikioki Packing Shed	RAM06	<1	4.7	108
Totokoitu Station	RAM08	30	7.1	104
Papua	RAM09	63	4.7	109
Arorangi School	RAM11	10	12.6	116
Social Centre	RAM13	<1	5.4	113
Muri Buoy	RAM16	10	5.2	90
Betela Beach	RAM17	74	7.0	108
Avatiu	RAM18	<1	4.2	118
Muri Koka	RAM19	20	1.9	95

Stream Site	Site ID	Enterococci (MPN/100ml)	Total Suspended Solids (mg/L)	Dissolved Oxygen (%)
Avana	RAS01	NW	NW	NW
Paringaru	RAS02	NW	NW	NW
Akapuao	RAS03	NW	NW	NW
Totokoitu	RAS04	NW	NW	NW
Betela	RAS06	416	3.7	55
Avatiu	RAS08	NW	NW	NW
Vaiterenga	RAS10	NW	NW	NW
Areiti	RAS11	830	30.9	53

GRADING SCALE	Excellent	Very Good	Good	Poor	Very Poor	Extremely Poor
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### Lagoon:

- Enterococci bacteria results were low with good to excellent levels at most sites. This indicated safe areas for swimming. However, Social Centre observed high results at 776 MPN/100mL with extremely poor levels. Resampling was carried out on Friday 2<sup>nd</sup> May. After 24hrs, result for Social Centre was low at <1 MPN/100mL with excellent levels showing this area was safe for swimming.
- Total suspended solids levels were very good to very poor that ranged from 1.7 mg/L to 12.6 mg/L, respectively.
- Dissolved oxygen levels ranged from good to excellent with readings above the recommended threshold of 80% at all sites.
- Temperature ranged from 24.1 degrees at Muri Koka to 26.9 degrees at Avatiu, giving an average of 25.2 degrees.

- Salinity ranged from 34.4 ppt at Betela Beach to 35.9 ppt at Social Centre, with an average of 35.4 ppt.
- pH ranged from 7.81 at Paringaru to 8.09 at Avatiu, resulting in an average of 7.93.

**Stream:**

- Betela and Areiti streams observed very poor and extremely poor levels, respectively with elevated Enterococci bacteria results.
- Levels of total suspended solids were good and extremely poor with results ranging from 3.7 mg/L to 30.9 mg/L at Betela and Areiti, respectively.
- Very poor levels of dissolved oxygen with readings of 55% and 53% were recorded at Betela and Areiti, respectively.
- Temperature ranged from 22.4 degrees at Betela to 24 degrees at Areiti, giving an average of 23.2 degrees.
- Salinity and pH readings were stable with averages of 0.3 ppt and 6.88, respectively.

The monthly summary reports, lab study reports and rainfall data can be found at the end of this report.



## RAROTONGA WATER QUALITY REPORT MAY 2025

### SUMMARY

Water samples were collected on Wednesday 28<sup>th</sup> May. Sunny weather with slight overcast was observed throughout the day with tides changing from low to high during sample collection. Halimeda, Caulerpa, Boodlea and cyanobacteria algae were observed at seven out of seventeen lagoon sites. Out of the twelve streams, six were flowing and samples collected. The remaining streams were not sampled due to seawater influence and stagnancy. Juvenile fish and eels were present in three streams that were sampled. The summarized main parameters are provided in the table below.

Lagoon Site	Site ID	Enterococci (MPN/100ml)	Total Suspended Solids (mg/L)	Dissolved Oxygen (%)
Pouara Raui	RAM03	10	3.3	125
Avana Mudflats	RAM04	160	0.5	110
Paringaru	RAM05	10	5.5	115
Tikioki Packing Shed	RAM06	10	3.0	123
Totokoitu Station	RAM08	<1	5.6	127
Papua	RAM09	10	0.3	125
Arorangi School	RAM11	10	2.3	132
Social Centre	RAM13	<1	1.3	130
Muri Buoy	RAM16	10	1.3	114
Betela Beach	RAM17	<1	0.3	130
Avatiu	RAM18	160	5.4	116
Muri Koka	RAM19	10	2.7	118
Ngatipa	RAM20	20	2.3	119
Matavera Outfall	RAM21	<1	4.3	123
Muri Aroko	RAM22	20	1.3	114
Tikioki	RAM23	<1	2.3	119
Papaaroa	RAM24	<1	1.3	127
Stream Site	Site ID	Enterococci (MPN/100ml)	Total Suspended Solids (mg/L)	Dissolved Oxygen (%)
Avana	RAS01	378	1.0	82
Paringaru	RAS02	921	6.7	93
Akapuao	RAS03	649	5.0	61
Totokoitu	RAS04	NW	NW	NW
Betela	RAS06	980	3.7	72
Avatiu	RAS08	461	1.0	82
Vaiterenga	RAS10	>2420	3.3	43
Areiti	RAS11	NW	NW	NW
Takuvaine	RAS12	NW	NW	NW
Pouara	RAS13	NW	NW	NW
Avana Mouth	RAS14	NW	NW	NW
Papua	RAS15	NW	NW	NW



GRADING SCALE	Excellent	Very Good	Good	Poor	Very Poor	Extremely Poor
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### Lagoon:

- Sixteen out of seventeen sites were safe for swimming due to good and excellent levels of Enterococci bacteria with low results ranging from <1 MPN/100mL to 160 MPN/100mL. Totokoitu Station showed very poor levels with a high result of 448 MPN/100mL. This site was resampled on Friday 30<sup>th</sup> May to

monitor the levels of Enterococci bacteria. The resampled result showed excellent levels at <1 MPN/100mL, indicating a safe swimming area.

- Most sites had low results with good to excellent levels of total suspended solids. However, Paringaru, Totokoitu Station and Avatiu observed poor levels with high results at 5.5 mg/L, 5.6 mg/L and 5.4 mg/L respectively.
- Dissolved oxygen levels were excellent at all sites.
- Temperature ranged from 26.1 degrees at Papua to 27.3 degrees at Paringaru and Muri Koka, giving an average of 26.6 degrees.
- Salinity ranged from 29.4 ppt at Arorangi School to 35.5 ppt at Pouara Raui and Matavera Outfall with an average of 33.6 ppt.
- pH ranged from 7.84 at Arorangi School to 8.08 at Pouara Raui and Ngatipa, mean average of 7.99.

#### **Stream:**

- All six streams observed very poor and extremely poor levels with elevated Enterococci bacteria results.
- Poor level of total suspended solids with a high result of 6.7 mg/L was observed at Paringaru. Levels at the remaining streams were good and very good with low results at 5.0 mg/L and under.
- Avana, Paringaru and Avatiu recorded good and very good levels of dissolved oxygen with high readings of 82%, 93% and 82%, respectively. The remaining sites observed poor and very poor levels with low readings between 43% and 72%.
- Temperature ranged from 23.5 degrees at Avana to 24.9 degrees at Akapuao and Vaiterenga, giving an average of 24.3 degrees.
- Salinity readings were stable ranging between 0.1 ppt and 0.2 ppt.
- pH readings ranged from 6.50 at Betela to 7.19 at Paringaru with an average of 6.75.

The monthly summary reports, lab study reports and rainfall data can be found at the end of this report.



## RAROTONGA WATER QUALITY REPORT JUNE 2025

### SUMMARY

Water samples were collected on Tuesday 10<sup>th</sup> June. Tides changed from low to high during sample collection. Halimeda algae was observed at four out of seventeen lagoon sites. Five out of twelve streams were flowing and sampled. Juvenile fish were present in three of the sampled streams. Seawater influence, stagnancy and no water were observed in the remaining streams, therefore could not be sampled. The table below summarize the levels of Enterococci bacteria, total suspended solids and dissolved oxygen.

Lagoon Site	Site ID	Enterococci (MPN/100ml)	Total Suspended Solids (mg/L)	Dissolved Oxygen (%)
Pouara Raui	RAM03	<1	0.3	129
Avana Mudflats	RAM04	75	1.5	114
Paringaru	RAM05	10	1.6	118
Tikioki Packing Shed	RAM06	<1	1.6	126
Totokoitu Station	RAM08	148	4.7	118
Papua	RAM09	10	2.4	124
Arorangi School	RAM11	86	1.0	131
Social Centre	RAM13	<1	3.3	126
Muri Buoy	RAM16	<1	0.3	113
Betela Beach	RAM17	187	2.0	122
Avatiu	RAM18	<1	1.0	154
Muri Koka	RAM19	20	1.0	115
Ngatipa	RAM20	10	1.0	122
Matavera Outfall	RAM21	<1	1.0	131
Muri Aroko	RAM22	63	1.0	115
Tikioki	RAM23	10	1.0	131
Papaaroa	RAM24	31	1.4	123
Stream Site	Site ID	Enterococci (MPN/100ml)	Total Suspended Solids (mg/L)	Dissolved Oxygen (%)
Avana	RAS01	NW	NW	NW
Paringaru	RAS02	411	0.3	74
Akapuao	RAS03	NW	NW	NW
Totokoitu	RAS04	816	0.3	99
Betela	RAS06	308	3.1	97
Avatiu	RAS08	109	1.4	99
Vaiterenga	RAS10	NW	NW	NW
Areiti	RAS11	28	7.3	75
Takuvaime	RAS12	NW	NW	NW
Pouara	RAS13	NW	NW	NW
Avana Mouth	RAS14	NW	NW	NW
Papua	RAS15	NW	NW	NW



GRADING SCALE	Excellent	Very Good	Good	Poor	Very Poor	Extremely Poor
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### Lagoon:

- Most sites were safe for swimming due to low Enterococci bacteria results with good to excellent levels. Totokoitu Station observed poor levels at 309 MPN/100mL. This site was resampled, and results were at 148 MPN/100mL with good levels that was safe for swimming.
- Low results below 5.0 mg/L at all sites showed good to excellent levels of total suspended solids indicating clearer waters and minimal threat to coral reefs.

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- Dissolved oxygen levels were above the recommended threshold of 80% showing excellent levels at all sites.
- Temperature ranged from 22.5 degrees at Muri Buoy to 26.6 degrees at Avatiu with an average of 23.9 degrees.
- Salinity was stable ranging from 32.8 ppt at Paringaru to 35.6 ppt at Matavera Outfall giving an average of 34.1 ppt.
- pH ranged from 7.93 at Paringaru to 8.15 at Avatiu, mean average of 8.01.

**Stream:**

- Enterococci bacteria ranged from excellent levels with low results of 28 MPN/100mL at Areiti to extremely poor levels with high results of 816 MPN/100mL at Totokoitu.
- Levels of total suspended solids were good to excellent with low results below 5.0 mg/L, except at Areiti that had poor levels and high results of 7.3 mg/L.
- Excellent levels with high results of dissolved oxygen were recorded at Totokoitu, Betela and Avatiu. Paringaru and Areiti recorded poor levels at 74% and 75%, respectively.
- Temperature ranged from 21 degrees at Totokoitu to 24.5 degrees at Paringaru, giving an average of 22.6 degrees.
- Salinity readings were stable, ranging from 0.1 ppt to 0.4 ppt with an average of 0.2 ppt.
- pH readings ranged from 6.77 at Betela to 7.53 at Avatiu, mean average of 7.16.

The monthly summary reports, lab study reports and rainfall data can be found at the end of this report.



## RAROTONGA WATER QUALITY REPORT JULY 2025

### SUMMARY

Water samples were collected on Tuesday 8<sup>th</sup> July. Weather was sunny and windy with tides changing from high to low during sample collection. Low poor clarity water was observed at a few lagoon sites from turbid waters flowing from nearby streams. All eight streams were flowing and samples collected. Juvenile fish, prawns, eels and Halimeda algae were present in a few streams. The table below provides a summary of the main parameters.

Lagoon Site	Site ID	Enterococci (MPN/100ml)	Total Suspended Solids (mg/L)	Dissolved Oxygen (%)
Pouara Raui	RAM03	<1	1.3	137
Avana Mudflats	RAM04	20	0.6	101
Paringaru	RAM05	75	2.9	102
Tikioki Packing Shed	RAM06	134	1.3	119
Totokoitu Station	RAM08	63	33.3	119
Papua	RAM09	185	7.8	125
Arorangi School	RAM11	109	6.8	131
Social Centre	RAM13	<1	1.9	124
Muri Buoy	RAM16	<1	0.5	104
Betela Beach	RAM17	<1	25.2	121
Avatiu	RAM18	<1	17.9	134
Muri Koka	RAM19	20	0.5	101

Stream Site	Site ID	Enterococci (MPN/100ml)	Total Suspended Solids (mg/L)	Dissolved Oxygen (%)
Avana	RAS01	649	1.0	95
Paringaru	RAS02	1203	2.7	79
Akapuao	RAS03	>2420	5.0	61
Totokoitu	RAS04	488	0.3	95
Betela	RAS06	1553	2.5	91
Avatiu	RAS08	299	2.0	91
Vaiterenga	RAS10	>2420	4.0	62
Areiti	RAS11	>2420	68.8	64

GRADING SCALE	Excellent	Very Good	Good	Poor	Very Poor	Extremely Poor
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### Lagoon:

- Pou'ara Ra'ui, Papua, Muri Buoy and Muri Koka observed good to excellent levels with low results that were safe for swimming. Eight out of twelve sites had to be resampled the next day due to elevated Enterococci bacteria results from 233 to 3,609 MPN/100mL. Resampled results showed improvement from <1 to 134 MPN/100mL at good to excellent levels that were safe for swimming.
- Levels of total suspended solids were poor to extremely poor with high results at Totokoitu Station, Papua, Arorangi School, Betela Beach and Avatiu. Remaining sites showed good to excellent levels with low results.
- Dissolved oxygen levels exceeded the recommended threshold of 80% with high readings indicating excellent levels at all sites.
- Temperature ranged from 22.7 degrees at Totokoitu Station to 24.1 degrees at Avatiu, giving an average of 23.4 degrees.

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- Salinity ranged from 21.4 ppt at Avatiu to 35.1 ppt at Social Centre with an average of 31.9 ppt. Takuvaine and Avatiu streams were flowing and may have contributed to the low salinity reading at Avatiu lagoon site.
- pH ranged from 7.95 at Totokoitu Station to 8.08 at Arorangi School, mean average of 8.01.

#### **Stream:**

- All streams observed poor to extremely poor levels with elevated Enterococci bacteria results.
- Most streams showed low results at 5 mg/L and under with good to excellent levels of total suspended solids. Areiti was the only stream with extremely poor levels and high results.
- Paringaru, Akapua, Vaiterenga and Areiti recorded low readings with poor dissolved oxygen levels below the recommended 80% threshold. The remaining sites recorded high readings with very good and excellent levels above the recommended 80% threshold.
- Temperature ranged from 21 degrees at Totokoitu Station to 22.6 degrees at Paringaru, giving an average of 21.7 degrees.
- Salinity and pH readings were stable with averages of 0.2 ppt and 6.69, respectively.

The monthly summary reports, lab study reports and rainfall data can be found at the end of this report.

**1. ENTEROCOCCI BACTERIAL COUNTS - RAROTONGA - Most Probable Number of Enterococci per 100 mL (MPN/100mL)**

Lagoon Site	Site ID	Feb	Mar	Apr	May	Jun	Jul
Pouara Raui	RAM03	<1	20	<1	10	<1	<1
Avana Mudflats	RAM04	50	97	10	160	75	20
Paringaru	RAM05	40	<1	135	10	10	75
Tikioki Packing Shed	RAM06	<1	<1	<1	10	<1	134
Totokoitu Station	RAM08	<1	156	30	<1	148	63
Papua	RAM09	<1	158	63	10	10	185
Arorangi School	RAM11	20	51	10	10	86	109
Social Centre	RAM13	<1	<1	<1	<1	<1	<1
Muri Buoy	RAM16	<1	31	10	10	<1	<1
Betela Beach	RAM17	<1	63	74	<1	187	<1
Avatiu	RAM18	20	<1	<1	160	<1	<1
Muri Koka	RAM19	<1	63	20	10	20	20
Ngatipa	RAM20	<1	NO DATA	NO DATA	20	10	NO DATA
Matavera Outfall	RAM21	<1			<1		
Muri Aroko	RAM22	<1			20	63	
Tikioki	RAM23	<1			<1	10	
Papaaroa	RAM24	20			<1	31	

Stream Site	Site ID	Feb	Mar	Apr	May	Jun	Jul
Avana	RAS01	249	1733	NW	378	NW	649
Paringaru	RAS02	1046	>2420	NW	921	411	1203
Akapuao	RAS03	1553	>2420	NW	649	NW	>2420
Totokoitu	RAS04	201	>2420	NW	NW	816	488
Betela	RAS06	1414	>2420	416	980	308	1553
Avatiu	RAS08	1553	NW	NW	461	109	299
Vaiterenga	RAS10	NW	>2420	NW	>2420	NW	>2420
Areiti	RAS11	46	613	830	NW	28	>2420
Takuvaine	RAS12	NW	NO DATA	NO DATA	NW	NW	NO DATA
Pouara	RAS13	816			NW	NW	
Avana Mouth	RAS14	NW			NW	NW	
Papua	RAS15	NW			NW	NW	



GRADING SCALE			REFERENCE
Excellent	A	< 41	WHO 2021 Guidelines on Recreational Water Quality for Coastal and Fresh Waters.
Very Good	B	41 ≥ 100	
Good	C	101 ≥ 200	
Poor	D	201 ≥ 350	
Very Poor	E	351 ≥ 500	
Extremely Poor	F	> 500	

## 2. TOTAL SUSPENDED SOLIDS - RAROTONGA - Milligrams per Litre (mg/L)

Lagoon Sampling Site	Site ID	Feb	Mar	Apr	May	Jun	Jul
Pouara Raui	RAM03	0.3	1.0	1.7	3.3	0.3	1.3
Avana Mudflats	RAM04	0.3	2.0	4.7	0.5	1.5	0.6
Paringaru	RAM05	0.3	3.0	6.8	5.5	1.6	2.9
Tikioki Packing Shed	RAM06	1.3	4.0	4.7	3.0	1.6	1.3
Totokoitu Station	RAM08	0.3	3.0	7.1	5.6	4.7	33.3
Papua	RAM09	0.5	3.0	4.7	0.3	2.4	7.8
Arorangi School	RAM11	1.3	5.0	12.6	2.3	1.0	6.8
Social Centre	RAM13	1.3	3.0	5.4	1.3	3.3	1.9
Muri Buoy	RAM16	0.3	1.0	5.2	1.3	0.3	0.5
Betela Beach	RAM17	0.3	2.0	7.0	0.3	2.0	25.2
Avatiu	RAM18	2.3	3.0	4.2	5.4	1.0	17.9
Muri Koka	RAM19	0.3	4.0	1.9	2.7	1.0	0.5
Ngatipa	RAM20	0.3	NO DATA	NO DATA	2.3	1.0	NO DATA
Matavera Outfall	RAM21	1.3			4.3	1.0	
Muri Aroko	RAM22	1.3			1.3	1.0	
Tikioki	RAM23	0.3			2.3	1.0	
Papaaroa	RAM24	1.3			1.3	1.4	

Stream Sampling Site	Site ID	Feb	Mar	Apr	May	Jun	Jul
Avana	RAS01	0.7	3.1	NW	1.0	NW	1.0
Paringaru	RAS02	1.0	6.1	NW	6.7	0.3	2.7
Akapuao	RAS03	5.2	4.5	NW	5.0	NW	5.0
Totokoitu	RAS04	0.8	8.7	NW	NW	0.3	0.3
Betela	RAS06	3.7	6.3	3.7	3.7	3.1	2.5
Avatiu	RAS08	2.6	NW	NW	1.0	1.4	2.0
Vaiterenga	RAS10	NW	8.8	NW	3.3	NW	4.0
Areiti	RAS11	1.3	2.1	30.9	NW	7.3	68.8
Takuvaine	RAS12	NW	NO DATA	NO DATA	NW	NW	NO DATA
Pouara	RAS13	1.1			NW	NW	
Avana Mouth	RAS14	NW			NW	NW	
Papua	RAS15	NW			NW	NW	

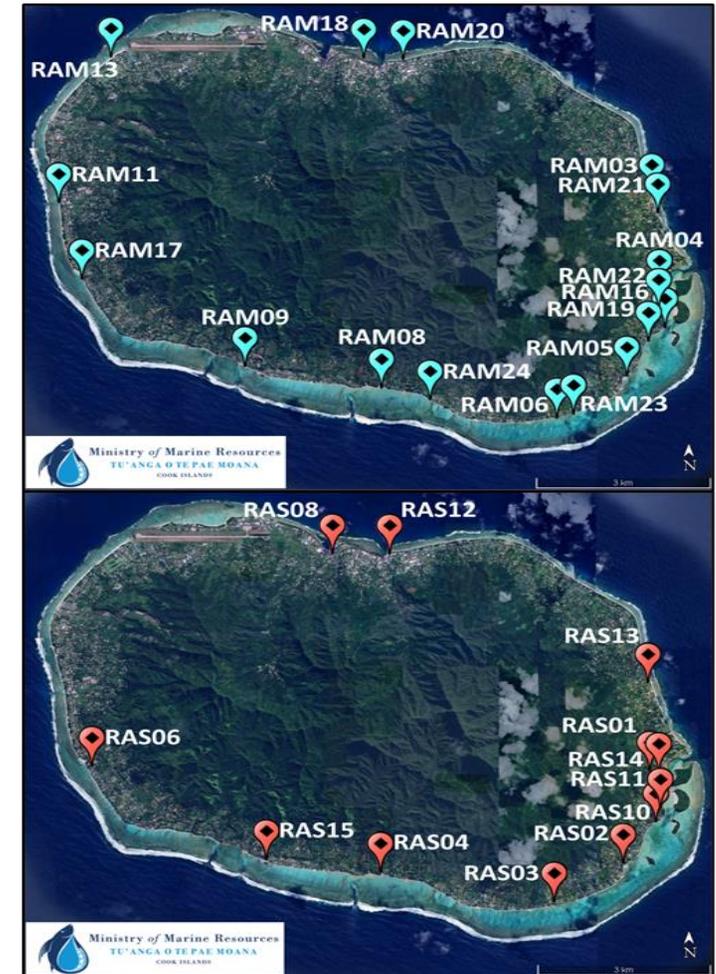


GRADING SCALE			REFERENCE
Excellent	A	< 1.0	Bell 1992, total suspended solids recommended limit is ≤5mg/L for healthy coral reef.
Very Good	B	1.0 ≥ 2.5	
Good	C	2.5 ≥ 5.0	
Poor	D	5 ≥ 10	
Very Poor	E	10 ≥ 20	
Extremely Poor	F	> 20	

### 3. DISSOLVED OXYGEN - RAROTONGA - Percent (%)

Lagoon Sampling Site	Site ID	Feb	Mar	Apr	May	Jun	Jul
Pouara Raui	RAM03	ND	97	107	125	129	137
Avana Mudflats	RAM04	ND	78	93	110	114	101
Paringaru	RAM05	ND	74	100	115	118	102
Tikioki Packing Shed	RAM06	ND	88	108	123	126	119
Totokoitu Station	RAM08	ND	88	104	127	118	119
Papua	RAM09	ND	97	109	125	124	125
Arorangi School	RAM11	ND	92	116	132	131	131
Social Centre	RAM13	ND	94	113	130	126	124
Muri Buoy	RAM16	ND	82	90	114	113	104
Betela Beach	RAM17	ND	92	108	130	122	121
Avatiu	RAM18	ND	95	118	116	154	134
Muri Koka	RAM19	ND	95	95	118	115	101
Ngatipa	RAM20	ND	NO DATA	NO DATA	119	122	NO DATA
Matavera Outfall	RAM21	ND			123	131	
Muri Aroko	RAM22	ND			114	115	
Tikioki	RAM23	ND			119	131	
Papaaroa	RAM24	ND			127	123	

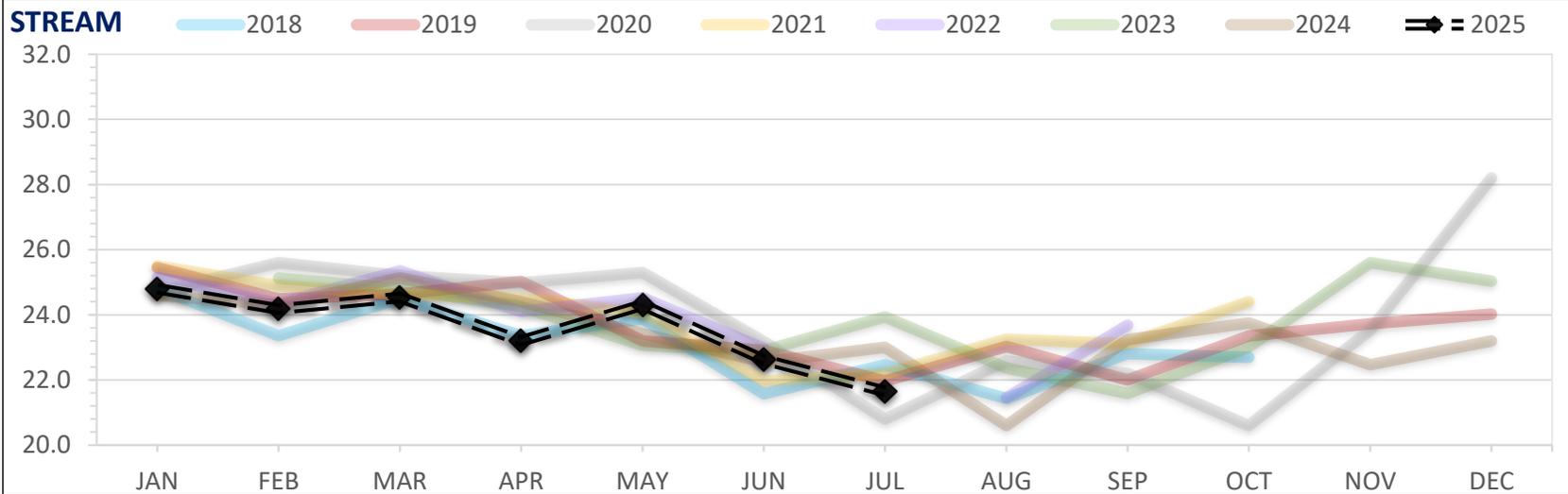
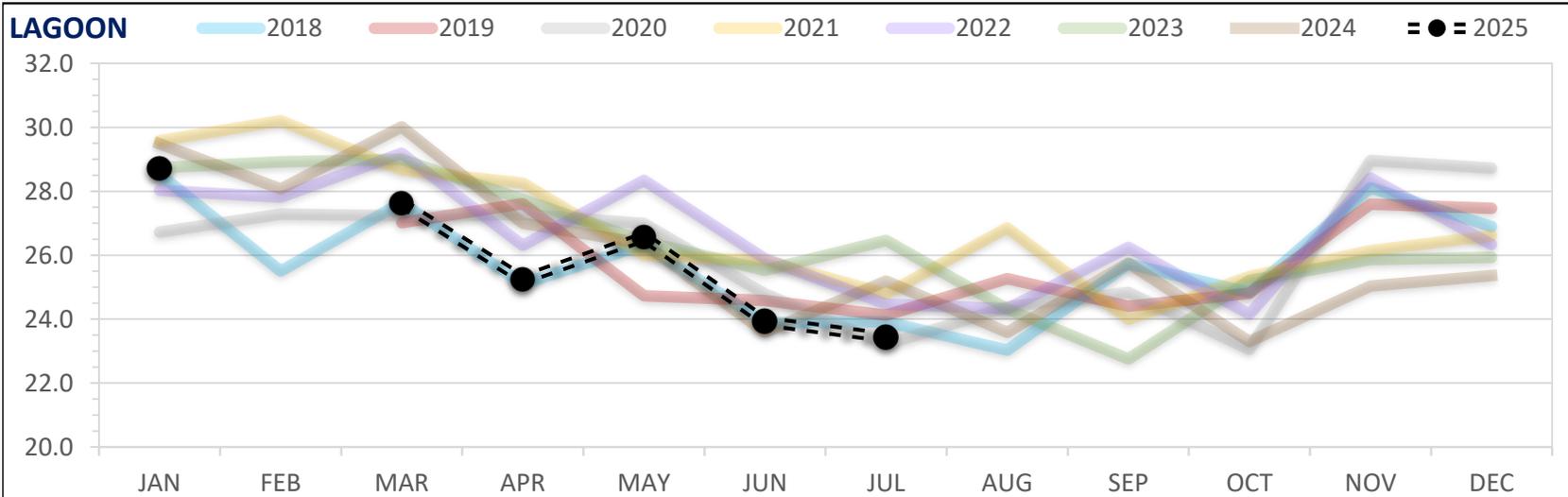
Stream Sampling Site	Site ID	Feb	Mar	Apr	May	Jun	Jul
Avana	RAS01	95	92	NW	82	NW	95
Paringaru	RAS02	93	64	NW	93	74	79
Akapuao	RAS03	82	36	NW	61	NW	61
Totokoitu	RAS04	96	94	NW	NW	99	95
Betela	RAS06	117	75	55	72	97	91
Avatiu	RAS08	93	NW	NW	82	99	91
Vaiterenga	RAS10	NW	35	NW	43	NW	62
Areiti	RAS11	72	25	53	NW	75	64
Takuvaine	RAS12	NW	NO DATA	NO DATA	NW	NW	NO DATA
Pouara	RAS13	63			NW	NW	
Avana Mouth	RAS14	NW			NW	NW	
Papua	RAS15	NW			NW	NW	



GRADING SCALE			REFERENCE
Excellent	A	>95	Department of Health, Clean Water Branch Hawaii 1994: Dissolved oxygen recommended limit is ≥75% saturation for oceanic waters, embayments, open coastal waters & estuaries; ≥80% saturation for streams.
Very Good	B	90 ≥ 95	
Good	C	80 ≥ 90	
Poor	D	60 ≥ 80	
Very Poor	E	40 ≥ 60	
Extremely Poor	F	< 40	

#### 4. AVERAGE TEMPERATURE - RAROTONGA - Degrees Celcius (°C)

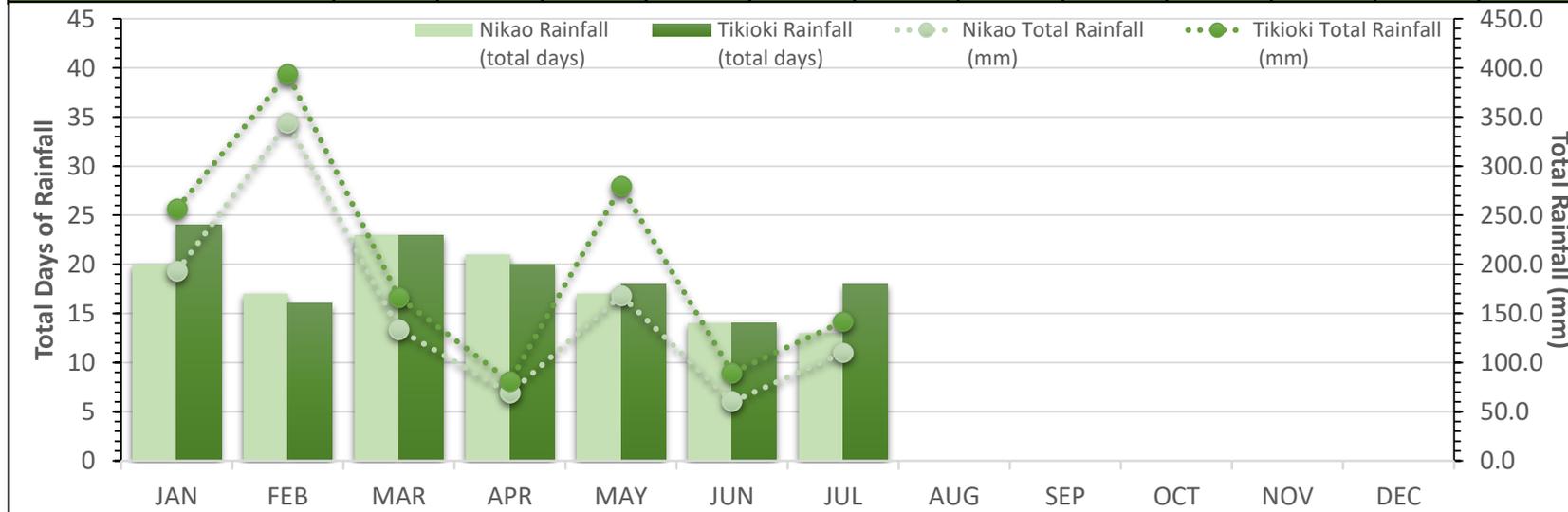
2025	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Lagoon	28.7	ND	27.6	25.2	26.6	23.9	23.4					
Stream	24.8	24.2	24.5	23.2	24.3	22.6	21.7					



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## 5. RAROTONGA RAINFALL - NIKAO & TIKIOKI - Total Rainfall (mm) & Total Days of Rainfall

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
<b>Nikao Total Rainfall (mm)</b>	192.6	344.3	133.6	68.8	168.3	60.0	110.2					
<b>Nikao Rainfall (total days)</b>	20	17	23	21	17	14	13					
<b>Nikao Highest 1-Day (mm)</b>	37.4	72.5	43.0	10.6	28.5	19.1	80.6					
<b>Nikao Highest 1-Day (date)</b>	9th	13th	3rd	2nd	24th	16th	6th					
<b>Tikioki Total Rainfall (mm)</b>	256.6	393.6	166.4	80.8	279.2	89.8	141.8					
<b>Tikioki Rainfall (total days)</b>	24	16	23	20	18	14	18					
<b>Tikioki Highest 1-Day (mm)</b>	83.8	94.4	53.6	13.0	67.8	48.0	79.6					
<b>Tikioki Highest 1-Day (date)</b>	9th	20th	30th	6th	15th	16th	6th					



<b>SAMPLE DESCRIPTION</b>
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Date Samples Collected:	Name of Sample:	Collected By:	Submitted By:	Time of Receipt:	Physical Description:	Quantity Per Site Received:
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Wednesday 30 <sup>th</sup> April	Marine	NES		11:10AM	Clear	2.5L
	Stream	MMR		10:40AM	Slightly turbid	

Study No.	1	2	3	4	5	6	7
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SITE ID	LAB ID	Enterococci (MPN/100ml)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH	Total Suspended Solids (mg/L)
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MARINE		<1	26.1	34.9	107.1	7.12	8.00	1.7
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RAM03	04L5137	<1	26.1	34.9	107.1	7.12	8.00	1.7
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RAM04	04L5138	10	24.6	35.3	92.9	6.32	7.91	4.7
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RAM05	04L5139	135	24.3	35.7	100.2	6.84	7.81	6.8
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RAM06	04L5140	<1	24.5	35.4	107.7	7.34	7.97	4.7
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RAM08	04L5141	30	24.5	35.5	103.9	7.08	7.90	7.1
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RAM09	04L5142	63	25.7	35.6	109.2	7.29	7.94	4.7
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RAM11	04L5143	10	26.0	35.6	115.9	7.69	7.95	12.6
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RAM13	04L5144	776	26.5	35.9	113.2	7.43	7.99	5.4
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RAM16	04L5145	10	24.4	35.9	89.7	6.10	7.87	5.2
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RAM17	04L5146	74	25.3	34.4	108.4	7.32	7.91	7.0
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RAM18	04L5147	<1	26.9	35.5	118.4	7.74	8.09	4.2
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RAM19	04L5148	20	24.1	35.5	95.4	6.54	7.83	1.9
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STREAM		&nbsp;						
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RAS06	04L5149	416	22.4	0.1	54.7	4.74	6.84	3.7
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RAS11	04L5150	830	24.0	0.4	53.0	4.45	6.92	30.9
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Study Method	IDEXX Enterolert*	YSI Manual	MMR Lab Manual Water Quality Monitoring V5					
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Recommended Limit	Ref. Comments							
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Resample #	Date Sample Collected	Time of Receipt	Physical Description	Quantity Per Site Received	Marine Study Parameter	Unit	RAM13 (04L5151)	Study Method	Recommended Limit
<b>1</b>	02.05.2025	8:30AM	Clear	500mL	Enterococci	MPN/100mL	<1	IDEXX Enterolert*	Ref. Comments

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Report Date: 02.07.2025		RAROTONGA LAB STUDY REPORT – MAY				Lab Report No.: 05L5165 – 05L5188				
SAMPLE DESCRIPTION										
Date Samples Collected:		Name of Sample:	Collected By:	Submitted By:		Time of Receipt:		Physical Description:	Quantity Per Site Received:	
Wednesday 28 <sup>th</sup> May		Marine	NES/MMR		1:50PM		Clear	2.5L		
		Stream	MMR		10:50AM		Clear and slightly turbid			
Study No.		1	2	3	4	5	6	7		
SITE ID	LAB ID	Enterococci (MPN/100ml)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH	Total Suspended Solids (mg/L)		
MARINE		RAM03	05L5165	10	26.4	35.5	125.1	8.25	8.08	3.3
RAM04	05L5166	160	26.9	34.0	110.1	7.27	7.95	0.5		
RAM05	05L5167	10	27.3	32.5	114.6	7.57	7.91	5.5		
RAM06	05L5168	10	26.7	34.6	122.5	8.09	7.99	3.0		
RAM08	05L5169	448	26.3	33.1	127.3	8.53	7.99	5.6		
RAM09	05L5170	10	26.1	34.1	124.8	8.34	8.04	0.3		
RAM11	05L5171	10	26.3	29.4	132.3	9.04	7.84	2.3		
RAM13	05L5172	<1	26.8	35.3	129.8	8.50	8.02	1.3		
RAM16	05L5173	10	26.5	35.2	113.8	7.50	7.97	1.3		
RAM17	05L5174	<1	26.3	29.6	130.0	8.87	7.96	0.3		
RAM18	05L5175	160	26.3	29.5	116.0	7.93	8.01	5.4		
RAM19	05L5176	10	27.3	34.0	118.2	7.75	7.97	2.7		
RAM20	05L5177	20	26.3	35.4	118.9	7.86	8.08	2.3		
RAM21	05L5178	<1	26.8	35.5	122.7	8.04	8.07	4.3		
RAM22	05L5179	20	26.7	34.6	113.7	7.50	7.99	1.3		
RAM23	05L5180	<1	26.5	34.8	119.0	7.86	7.96	2.3		
RAM24	05L5181	<1	26.2	34.9	127.0	8.43	7.97	1.3		
STREAM		RAS01	05L5182	378	23.5	0.1	82.4	7.01	6.81	1.0
RAS02	05L5183	921	24.8	0.2	92.9	7.70	7.19	6.7		
RAS03	05L5184	649	24.9	0.2	60.6	5.01	6.85	5.0		
RAS06	05L5185	980	23.9	0.1	72.2	6.09	6.50	3.7		
RAS08	05L5186	461	23.8	0.1	81.8	6.90	6.57	1.0		
RAS10	05L5187	>2420	24.9	0.2	42.5	3.52	6.56	3.3		
Study Method		IDEXX Enterolert*	YSI Manual	YSI Manual	YSI Manual	YSI Manual	YSI Manual	YSI Manual	MMR Lab Manual Water Quality Monitoring V5	
Recommended Limit		Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments	
Resample #	Date Sample Collected	Time of Receipt	Physical Description	Quantity Per Site Received	Marine Study Parameter	Unit	RAM08 (05L5188)	Study Method	Recommended Limit	
1	30.05.2025	8:30AM	Clear	500mL	Enterococci	MPN/100mL	<1	IDEXX Enterolert*	Ref. Comments	

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Report Date: 03.07.2025		RAROTONGA LAB STUDY REPORT – JUNE				Lab Report No.: 06L5203 – 06L5225			
SAMPLE DESCRIPTION									
Date Samples Collected:		Name of Sample:	Collected By:	Submitted By:		Time of Receipt:		Physical Description:	Quantity Per Site Received:
Tuesday 10 <sup>th</sup> June		Marine	NES		12:05PM		Clear	2.5L	
		Stream	MMR		11:05AM		Clear and slightly turbid		
Study No.		1	2	3	4	5	6	7	
SITE ID	LAB ID	Enterococci (MPN/100ml)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH	Total Suspended Solids (mg/L)	
MARINE									
RAM03	06L5203	<1	25.0	35.5	128.7	8.69	8.03	0.3	
RAM04	06L5204	75	22.8	33.5	113.9	8.08	7.99	1.5	
RAM05	06L5205	10	22.8	32.8	118.2	8.42	7.93	1.6	
RAM06	06L5206	<1	23.4	33.3	125.8	8.84	8.00	1.6	
RAM08	06L5207	309	23.2	33.7	117.8	8.29	7.94	4.7	
RAM09	06L5208	10	24.6	34.2	123.5	8.46	8.02	2.4	
RAM11	06L5209	86	24.8	34.1	131.2	8.96	8.07	1.0	
RAM13	06L5210	<1	24.9	35.5	125.9	8.52	8.04	3.3	
RAM16	06L5211	<1	22.5	33.8	113.1	8.04	7.98	0.3	
RAM17	06L5212	187	24.5	34.2	122.4	8.39	8.04	2.0	
RAM18	06L5213	<1	26.6	33.1	154.3	10.28	8.15	1.0	
RAM19	06L5214	20	23.0	33.9	115.2	8.14	8.00	1.0	
RAM20	06L5215	10	24.8	35.1	121.8	8.26	7.96	1.0	
RAM21	06L5216	<1	24.9	35.6	131.1	8.86	8.09	1.0	
RAM22	06L5217	63	22.6	34.0	114.5	8.13	7.98	1.0	
RAM23	06L5218	10	23.4	33.6	130.7	9.18	8.06	1.0	
RAM24	06L5219	31	23.0	33.7	123.1	8.69	7.94	1.4	
STREAM									
RAS02	06L5220	411	24.5	0.3	74.1	6.17	6.93	0.3	
RAS04	06L5221	816	21.0	0.1	99.0	8.81	7.23	0.3	
RAS06	06L5222	308	21.6	0.1	96.9	8.54	6.77	3.1	
RAS08	06L5223	109	23.0	0.2	99.2	8.51	7.53	1.4	
RAS11	06L5224	28	23.0	0.4	75.4	6.44	7.33	7.3	
Study Method		IDEXX Enterolert*	YSI Manual	YSI Manual	YSI Manual	YSI Manual	YSI Manual	MMR Lab Manual Water Quality Monitoring V5	
Recommended Limit		Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments	
Resample #	Date Sample Collected	Time of Receipt	Physical Description	Quantity Per Site Received	Marine Study Parameter	Unit	RAM08 (06L5225)	Study Method	Recommended Limit
1	12.06.2025	9:50AM	Clear	500mL	Enterococci	MPN/100mL	148	IDEXX Enterolert*	Ref. Comments

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**SAMPLE DESCRIPTION**

Date Samples Collected:	Name of Sample:	Collected By:	Submitted By:	Time of Receipt:	Physical Description:	Quantity Per Site Received:
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Tuesday 8 <sup>th</sup> July	Marine	NES		11:05 AM	Clear	2.5L
	Stream	MMR		11:15 AM	Slightly turbid	

Study No.	1	2	3	4	5	6	7
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SITE ID	LAB ID	Enterococci (MPN/100ml)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH	Total Suspended Solids (mg/L)
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**MARINE**

RAM03	07L5226	<1	23.6	33.7	137.4	9.60	8.04	1.3
RAM04	07L5227	233	23.6	31.5	101.4	7.19	8.00	0.6
RAM05	07L5228	480	23.5	33.0	102.4	7.19	7.97	2.9
RAM06	07L5229	249	23.1	32.6	119.4	8.48	8.04	1.3
RAM08	07L5230	882	22.7	32.9	118.5	8.45	7.95	33.3
RAM09	07L5231	185	23.0	31.6	124.6	8.91	7.98	7.8
RAM11	07L5232	3609	23.7	34.7	131.3	9.10	8.08	6.8
RAM13	07L5233	318	23.5	35.1	124.1	8.61	8.05	1.9
RAM16	07L5234	<1	23.5	33.3	103.7	7.28	8.01	0.5
RAM17	07L5235	1043	23.0	29.9	120.7	8.71	8.00	25.2
RAM18	07L5236	420	24.1	21.4	134.0	9.96	8.03	17.9
RAM19	07L5237	20	23.9	33.5	100.9	7.03	7.98	0.5

**STREAM**

RAS01	07L5238	649	21.1	0.1	95.1	8.46	6.67	1.0
RAS02	07L5239	1203	22.6	0.2	78.5	6.78	6.73	2.7
RAS03	07L5240	>2420	21.7	0.2	60.6	5.33	6.53	5.0
RAS04	07L5241	488	21.0	0.1	95.2	8.49	6.86	0.3
RAS06	07L5242	1553	21.5	0.1	90.9	8.01	6.59	2.5
RAS08	07L5243	299	21.7	0.1	91.2	8.01	6.83	2.0
RAS10	07L5244	>2420	21.8	0.3	62.0	5.44	6.71	4.0
RAS11	07L5245	>2420	21.8	0.2	63.5	5.57	6.63	68.8

Study Method	IDEXX Enterolert*	YSI Manual	MMR Lab Manual Water Quality Monitoring V5				
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Recommended Limit	Ref. Comments						
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Resample #	Date Sample Collected	Time of Receipt	Physical Description	Quantity Per Site Received	Marine Study Parameter	Unit	RAM04 (07L5246)	RAM05 (07L5247)	RAM06 (07L5248)	RAM08 (07L5249)	RAM11 (07L5250)	RAM13 (07L5251)	RAM17 (07L5252)	RAM18 (07L5253)	Study Method	Recommended Limit
1	09.07.2025	3PM	Clear	500mL	Enterococci	MPN/100mL	20	75	134	63	109	<1	<1	<1	IDEXX Enterolert*	Ref. Comments

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## Abbreviation

NL: Not Listed, MPN: Most Probable Number, cfu: Colony Forming Unit, mL: milli Litre, FAU: Formazin Attenuation Unit, NTU: Nephelometric Turbidity Unit, ppt: Parts Per Thousand, DB: Designated Bathing Beach, MB: Moderate Use of Bathing, LB: Light Use of Bathing, IB: Infrequent Use of Bathing  
NA: Not Available, however data will be available at a later date; ND: No Data due to equipment failure or logistics problems or time delay or methodology problem or combination of all; NW: No Water, stream dry or water stagnant or water level too low for sample collection or water dirty/murky.

## Comments

1. Temperature<sup>#</sup>

Subtropical regions (south of Cape Canaveral and Tampa Bay, Florida, and Hawaii).  
Short-term Max. 32.2°C, Max. True daily mean 29.4°C (average of 24-hourly temperature reading).  
Temperature is the measure of warmth and coldness, reported as an average and measured in degrees celcius (°C).
2. pH  
Changes to pH can be caused by a range of potential water quality problems (e.g., low values due to acid sulphate runoff). pH values are also related to soil geology and may be naturally low or high (in limestone areas). High pH values can also be caused temporarily when high rates of photosynthesis by aquatic plants (including algae) lead to a decrease in carbon dioxide, and therefore a decrease in carbonic acid in the water.
3. Salinity  
A measure of the amount of dissolved salts in the water, and therefore an indicator of salinity. Excess salinity in freshwater streams occurs as a result of excess soil salinity, which may be caused by excess land clearing and changes to the groundwater table. Salinity is reported as parts per thousand (ppt).
4. Dissolved Oxygen<sup>^</sup>

DO levels indicate how much oxygen is in the water. Low DO levels indicate an abnormal disturbance in the ecosystem such as an algal bloom. DO is measured in percentage (%).  
Low DO: 3.5 mg/L at 26C leads to 100% mortality of *Acipenser oxyrhincus*  
2.7 mg/L at 19C leads to 22% mortality of *Acipenser oxyrhincus*  
<3.7 mg/L Demersal finfish biomass diminishes  
<3.5 mg/L Species richness diminishes  
Below 2 mg/L infaunal species migrate to sediment surface and epifaunal species move to better aerated water.  
Oxygen is essential for life processes of most aquatic organisms. Many aquatic organisms will suffocate if there is insufficient oxygen in the water.
5. Suspended Solids<sup>@</sup>

Settleable and suspended solids should not reduce the depth of the compensation point for photosynthetic activity by more than 10% from the seasonably established norm for aquatic life. Total suspended solids (TSS) are non-living (inorganic) such as silt and mud; and organic matter such as animal and plant material found in the water. The presence of large amounts of particles are responsible for creating the murky appearance of dirty water and can quickly kill coral reefs. TSS is measured in milligrams per litre (mg/L).
6. Turbidity  
Water clarity (the degree of light penetration) is important as aquatic plants depend on light to photosynthesize and produce oxygen. Large amounts of sediment in a water body can also smother benthic organisms. Suspended solid results are interactive and interdependent with turbidity. Expert interpretation needed. Turbidity is measured as FAU.
7. Enterococci<sup>β</sup>

The presence of bacteria Enterococci *sp* is monitored as an indicator of human and animal waste pollution. The higher the numbers of Enterococci bacteria present in a sample, the greater the amount of faecal pollution in the water. Bacteria count is measured in Most Probable Number of Enterococci cells per 100mL of sample (MPN/100mL).
8. Nutrients (Nitrate, Nitrite, Ammonia, Phosphate)  
High nutrient concentrations in a water body (eutrophication) may lead to excessive weed and algal growth. Excess nutrients enter a water body through several means, including discharge of treated sewage, storm water, and in run-off from land, for example as fertiliser, animal waste, or decaying plant matter.
9. Chlorophyll-a  
Chlorophyll-a is a pigment found in green plants, including aquatic plant. Measuring the amount of chlorophyll-a in the water therefore indicates the amount of green algae present in the water. High concentrations of algae (algal blooms) may harm other aquatic organisms, either through the production of toxins, reduction of available light through covering the water surface, or by using all available oxygen during respiration at night. Chlorophyll-a is measured in micrograms per litre (µg/L).
10. Rainfall  
Rarotonga: daily rainfall data is provided by the Cook Islands Meteorological Service.  
Aitutaki: daily rainfall data is recorded by MMR Staff (Aitutaki Marine Research Centre – AMRC) at Amuri and by Rowan Strickland at Vaipae.  
Rainfall is measured in millimetres (mm) and reported as an average per month, total number of days that had no rainfall and the highest amount of rainfall in 1-day.

<sup>#</sup>EPA Quality Criteria for Water Gold Book 1986

<sup>^</sup>EPA Ambient Aquatic Life Water Quality Criteria for DO (Saltwater): Cape Cod to Cape Hatteras Nov 2000

<sup>@</sup>EPA Quality Criteria for Water Red Book 1976

<sup>β</sup>WHO Guidelines on Recreational Water Quality for Coastal and Fresh Waters 2021