Water Quality in Port Vila, Vanuatu Harbor and Lagoon

Department of Water Resources PWWC 7 August 2019



For Monitoring the Harbor we used membrane filtration



Harbor Sampling Sites



Harbor Water Quality Results

Parameter	Marine Water Condition	Notes
Temperature		Within guidelines
PH		Within guidelines.
TDS		TDS results were within the expected natural range.
Dissolved Oxygen		Most areas of the harbor returned DO results above the minimum guideline although results opposite the market area were depressed relative to other areas
Nutrients		Majority within guidelines. Nutrient fate requires more investigation.
Suspended Solids		The provisional guideline value was consistently exceeded in the November sampling round. It is unclear at this time whether this is related to the cumulative effects of the foreshore works and dredging in the harbor, wind and tide effects or simply natural variation. More investigation is required.
Bacterial Organisms		Significant exceedances for Total Coliform (41 of 51 samples) and E. coli (27 of 51 samples). Entercocci detected 16/51 with 9/51 exceedances. Significant cause for concern about recreational and livelihood use of marine waters. Requires further monitoring.

Microbiology Terminology

Coliforms

- General indicator of potential contamination with pathogenic organisms
- Can originate from non-faecal sources
- Escherichia coli (E.coli)
 - Live in intestine of humans & other animals
 - Enter environment in faeces
- Enterococci

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- Enter environment in faeces
- Not present in all faeces i.e. only from infected people







Total Coliforms were mostly lower during 2018 testing

Total Colifom (2016 - 2018)



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However, in most locations Total Coliforms is above guideline value

Marine Total Coliform Results

Marine Total Coliforms and Recreational Guideline Value



In some monitoring points, the E. Coli level was higher in 2018



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Some locations in 2018 were still above the guidelines

Marine E.coli Results

Marine E. coli Results and Recreational Guideline Value



No point means result < Limit of Reporting or no sample

Fecal Streptococcus levels higher in 2018



Entercocci levels are in many locations above the guidelines

Marine Entercocci Results

Marine Enterococci and Recreational Guideline Value



No point means result < Limit of Reporting

As a result of these tests, swimming in the harbor was banned





Port Vila Master Bathers Club Test results were negative in 2019

Sample	Fecal C	ENT		Sample
	18-	Sep		
Beach	319		29	Beach
B Buoy	29		9	B Buoy
Helipad	0		10	Helipa
Rock	0		9	Rock

Sample	Fecal C	ENT
	19-	Feb
Beach	13	0
B Buoy	27	16
Helipad	11	4
Rock	7	0

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		Dec-18		c-18 19-May				
	Beach	1	1	Beach	0	0		
	B Buoy	25	31	B Buoy	0	0		
	Helipad	4	2	Helipad	0	0		
	Rock	2	1	Rock	0	0		
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Lagoon Sites were tested at low and hide tests





Lagoon Sites were testing using CBT E. Coli test

U.S. EPA Recreational Water Health Risk Category Based or MPN and Upper 95% Confidence Level	Upper 95% Confidence Level/100mL	MPN/100mL	Compartment Number				
			5	4	3	2	1
			1mL	3mL	56mL	30mL	10mL
Low Risk/Safe	28.70	0					
Low Risk/ Probably Safe	51.40	10	-				
	47.40	10					-
	51.60	11	_				
	56.40	12					
	78.10	15					
	63.20	20					
	68.50	21					
	66.40	21					
	78.10	24	-				
	81.20	24					
	85.10	26					
	83.80	32		-			
	97.00	37					
	113.60	31					
	118.20	32					
	125.30	34					
	104.30	39		-			
	109.40	40					
	227.50	47				1	
	147.30	52					
Low Risk/Possi	129.30	54					
Safe	171.40	56					
	168.70	58					
	211.90	84					
Intermediate	370.40	91					
Risk/Possibly S	376.80	96					
High Risk/Prob	830.60	136		-			
Unsafe	563.50	171					
Very High	1455.50	326		-		1	
Risk/Unsafe	3519.10	483					
Verv Unsafe	94351.00	>1000	1.			1	



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Pacific Lagoon Sites were safer at low tide

- 19/05/2019 5.45pm: high tide
 >1000 MPN/100mL -> Very unsafe
- 20/05/2019 12:45pm: low tide 0 MPN/100ML \rightarrow low risk/Safe
- 28/05/2019
 7 am: low tide
 12 MPN/100ML → Probably safe
- 12.35pm: high tide

136 MPN/100ML \rightarrow High risk/Very unsafe



Erakor - R

- 19/05/2019, 7.55AM (High tide)
 136 MPN/100mL-> High risk
 Probably unsafe
- 19/05/2019, 1.40pm (low tide)
 ~47 MPN/100 ml → possibly safe?
- 19/05/2019, 1.55pm (discharge) >1000MPN/100mL \rightarrow Very unsafe





Sometimes, high tide was safer

Erakor - R

- 28/05/2019
- 7.57AM (low tide)
 >1000 MPN
 Very unsafe
- 12.55 PM (High tide)
 84 MPN/100mL-> High risk
 Possibly safe



On the 19th the hospital seemed very unsafe

Hospital

19/05/2019
 6.55 AM (high tide): >1000 MPN/100mL
 → Very Unsafe

12.05pm(low tide): >1000 MPN/100mL \rightarrow Very Unsafe

12.30pm(low tide): >1000 MPN/100mL \rightarrow Very Unsafe (discharge)



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On the 28th, a high tide test was probably safe

Hospital

28/05/2019 8.30 AM (high tide): 24MPN/100mL

 \rightarrow Probably safe

2.15 PM (high tide): 96MPN/100mL \rightarrow High risk/ Unsafe



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Between lagoon 1 and 2

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19/05/2019 11AM (Low tide): 483 MPN/100mL \rightarrow Very High Risk/Unsafe

28/05/2019 9.10 AM (low tide): >1000 MPN/100mL \rightarrow Very Unsafe 2.40pm (high tide): 21MPN/100mL \rightarrow Probably safe





Lagoon 2 (Hippic centre)

28/05/2019
 9.40AM (low tide):39
 MPN/100mL
 → Probably safe

0,0

3PM (high tide): 136 MPN/100mL \rightarrow High risk/Probably unsafe



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Entrance Erakor Lagoon

June 3, 2019

12.27 PM (low tide):26 MPN/100mL

 \rightarrow Probably safe







Dye Tracer showed no treatment of wastewater



Conclusion

- Additional sample collection is needed on a regular basis
- Understanding circulation within the lagoons is crucial to improve water quality in the lagoon system
- Waste water discharge needs to be managed differently considering tide, volume of waste water and its neighbourhood





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Thank you for your attention :)