

Prepared for To Tatou Vai

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Acronyms

AVG Automatic valveless gravity filter
NES National Environmental Services

OEMP Operational environmental management plan

PACI Poly Aluminium Chloride
SOP Standard operating procedure

SS Suspended solids
ST Settling Tank
TTV To Tatou Vai

WTP Water Treatment Plant

<u>Units</u>

μg/L milligrams per liter

Kg Kilograms

E. Coli Escherichia coli (E. coli) bacteria normally live in the intestines of people and animals.

Most *E. coli* are harmless and actually are an important part of a healthy human intestinal tract. However, some *E. coli* are pathogenic, meaning they can cause illness, either diarrhea or illness outside of the intestinal tract. The types of *E. coli* that can cause diarrhea can be transmitted through contaminated water or food, or through contact with animals or persons. (https://www.cdc.gov/ecoli/general/index.html)

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Explanation

This supplementary plan is informed by the operational environment management plan main report. It provides for the management of environmental hazards and risks outside of the potential hazards and risks caused by the PACI. The plan covers the following:

- 1. Location of the Pāpua Water Treatment Plant;
- 2. Areas where there are likely significant potential adverse environmental impacts;
- 3. How the Water Treatment Plant works;
- 4. Management of potential environmental hazards and risks; and
- 5. Summary of Recommendations and Monitoring Programme

1. Where is the Pāpua Water Treatment Plant?



Figure 1 - Location of Rarotonga's Water Treatment Plants with Pāpua in red

2. Pāpua Water Treatment Plant – Areas where there are likely significant potential adverse environmental impacts.



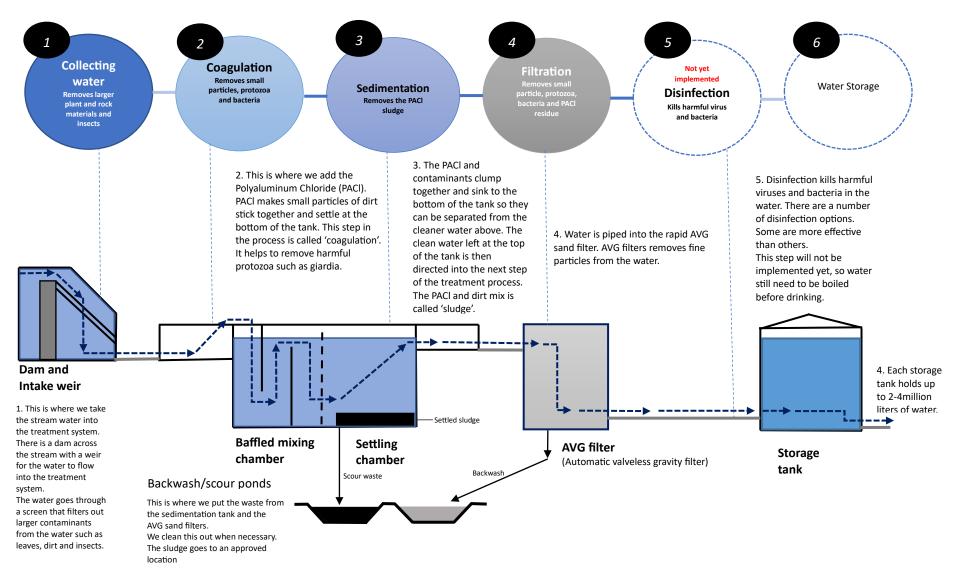
from the environment

Risk on the Environment Approximate position of the Stream

Note: Areas of risk from PACI is addressed in the main OEMP Report.

3. How the WTP work?

Figure 3 - How the Pāpua Water Treatment Plant work (Source: TTV sign boards at each WTP)



4. Management of Environmental Hazards and Risks

All hazards and risks are identified and using the risk assessment methodology attached in the Appendices Section as 6.1. The meaning of the color code: Red = Very High Risk, Brown = High Risk, Yellow = Medium Risk, Blue = Low Risk and Green = Very Low Risk.

WTP Location	Hazards and Risks (What they are and level of risk)	Potential Impacts	Mitigation Strategy	Monitoring Parameter	Monitoring Programme	Responsibility	Staff and equipment Requirement	Oversight
Pāpua	The result of long-term accumulation of organic material behind the weir during low water flow IC = Minor P = Low	Increased dissolved organic carbon behind the weir at the Intake - can contribution to increased dissolved organic carbon in the water which can influence the solubility level of aluminum in the water.	Short term + keep the area behind immediately behind the weir at the intake free of accumulated organic debris + Check twice weekly	- Accumulation of organic debris behind the weir especially during low water flow.	+ Keep an eye out for accumulation especially during times of low water flow. + Increase rotting smell of vegetation in the water. + Check twice weekly	+ Operator (s)	+ Operator (s) + 4 the more the better.	+ Supervisor
	Increased E. Coli at Source. IC = Moderate P = High	- E. Coli from insects, geckos, skinks, bats, chickens, rats and dogs E. Coli stored on leaf detritus that is broken down and released into the water when it floods Adverse impact on the water quality Increase sludge in settling pond.	Short term + Keep intake free of accumulated organic detritus. + Check twice weekly Long term + Ongoing water testing + Awareness activities through the Tourism sector.	- E. Coli level	+ Continue with water testing programme. + Manage use of trek trail across the island.	+ Operator (s) + TTV laboratory staff + Tourism sector and Public Health.	+ Operator (s) + TTV laboratory	+ Supervisor
	Increase suspended solids IC = Moderate P = Medium	- Adverse impact on the water quality. - increase sludge in settling pond.	+ Keep vegetation along lower slopes short. + Eliminate invasive species, e.g., pīpī-vai, rau-māniota and kākā.	- Suspended solid level	+ Continue with water testing programme	+ Operator (s) + TTV laboratory staff	+ Operator (s) + 4 the more the better.	+ Supervisor

WTP Location	Hazards and Risks (What they are and level of risk)	Potential Impacts	Mitigation Strategy	Monitoring Parameter	Monitoring Programme	Responsibility	Staff and equipment Requirement	Oversight
			+ Regular inspection of inner stream for overgrowth.					
	Debris accumulation behind weir if not removed. IC = Major P = High	- Erosion along the banks behind the weir during flooding Rocks will roll over the screen and cause harm to people below, e.g., Papua.	Short term + Develop SOP for removal of debris. + Removal of debris from behind the weir. Long term + Investigate and construct silt trap options further inland of the intake and weir to minimize erosion.	- SOP - Debris deposits and volume of deposit.	+ Monthly check + After major rainfall. + Maintenance of silt trap options. + Number of tourists injured and complaints from the tourist sector	+ Operator (s) + Supervisor	+ Operator (s) x4 the more the better and with shovels	+ Manager + Supervisor
	Removal of debris from behind weir. IC = Moderate P = Medium	- Erosion in the catchment area May increase slips in the catchment area Increase sediment entering WTP.	Short term + Develop SOP for controlled release of materials downstream. + Controlled release of material downstream. Long term + Request for NES approval for controlled release of material downstream. + Investigate and construct silt trap options further inland of the intake and weir to minimize erosion.	- SOP - Debris deposits and volume of deposits When debris level is critical and after major rainfall Volume of material released.	+ Daily check + After major rainfall. + Number of tourists injured and complaints from the tourist sector.	+ Operator (s) + Supervisor	+ Operator (s) x4 during removal, the more the better.	+ Manager + Supervisor

5. Summary of Recommendations and Monitoring Programme

The following are recommended actions to improve the operation and effective management of this WTP.

Hazards and	Recommendations	Monitoring Programme
Risks (What		
they are and		
level of risk)		
Increased E.	+ Keep intake free of accumulated organic detritus.	+ Continue with water testing programme.
Coli at Source.	+ Check twice weekly	+ Manage use of trek trail across the island.
	+ Ongoing water testing	
	+ Awareness activities through the Tourism sector	
Increase	+ Keep vegetation along lower slopes short.	+ Continue with water testing programme
suspended	+ Eliminate invasive species, e.g., pīpī-vai, rau-māniota and kākā.	
solids	+ Regular inspection of inner stream for overgrowth.	
Debris	+ Develop SOP for removal of debris.	+ Monthly check
accumulation	+ Removal of debris from behind the weir.	+ After major rainfall.
behind weir if	+ Investigate and construct silt trap options further inland of the intake and	+ Maintenance of silt trap options.
not removed.	weir to minimize erosion.	+ Number of tourists injured and complaints from the tourist sector
Removal of	+ Develop SOP for controlled release of materials downstream.	+ Daily check
debris from	+ Controlled release of material downstream.	+ After major rainfall.
behind weir.	+ Request for NES approval for controlled release of material downstream.	+ Number of tourists injured and complaints from the tourist sector.
	+ Investigate and construct silt trap options further inland of the intake and	
	weir to minimize erosion.	

6. Appendices

6.1 Risk Assessment Methodology Used

The assessment of risks involved for each hazard is provided below in Tables 1 and 2.

Table 1 Level of risk impact and probability

Risk Criteria	Definition of Rating	Score
	A: Extent – The area over which the impact will be experienced	Local = 1; Island = 2; and National = 3
Impact (I)	B: Intensity – The magnitude of the impact, i.e., whether the impact will result in minor, moderate, major or catastrophic environmental, social and economic (including human health) changes	Low = 1; Medium = 2; and High = 3
	C: Duration – The time frame over which the impact will be experienced and its reversibility.	Short Term – 1; Mid Term – 2; and Long Term – 3
In	npact Consequences (Combined Score): Minor 3 – 4; Moderate 5 – 6; Major 7	7 – 8; Massive 9 – 10.
Probability	Improbable - Unlikely to occur during project lifetime	1
(P) –	Possible - May occur during project lifetime 20%-60% chance of occurring	2
Likelihood of the	Probable - Likely to occur during the project lifetime >60-90% chance of occurring	3
impact occurring	Highly probable - Highly likely to occur, or likely to occur more than once during project lifetime	4

Table 2 Matrix showing overall significance of the impact as a combination of the consequences and probability rating

		Probability of Occurrence					
		Improbable	Possible	Probable	Highly Probable		
of	Minor	Very Low	Very Low	Low	Low		
Consequences of Impact	Moderate	Low	Low	Medium	Medium		
lmsequ	Major	Medium	Medium	High	High		
Co	Catastrophic	High	High	Very High	Very High		

6.2 To Tatou Vai (TTV) Water Treatment Plant (WTP) Operator's Daily Check List (Source: TTV Treatment Division)

Date WTP	Sludge Level (%)	Bulk Tank (%)	Dose Rate (mg/L or g/m³)	Intake (NTU)	ST (NTU)	Post AVG (NTU)	Reservoir (NTU)	Flow Rate (L/Sec)	Reservoir (KPA)	Comments

Note: PACI storage tank (how full it is in %), PACI header tank (Float valve and arm), the sludge level in the settling tank (from bottom of tank to mid-way level in %), adjusting the dosing level of PACI (in mg/L), Intake (NTU), Sediment tank (Float valve arm at the NTU), Post AVG (NTU), RES (NTU) Flow rate (L/sec)