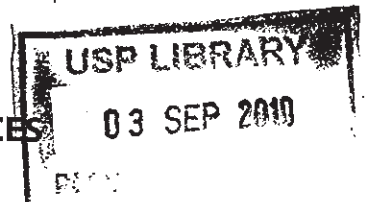


Pac GE 320; FA I 2



INSTITUTE OF APPLIED SCIENCES

THE UNIVERSITY OF THE SOUTH PACIFIC

Coastal Water Quality surrounding the Site for the proposed Fisheries
Jetty, Lami

IAS ENVIRONMENTAL STUDIES REPORT NUMBER: C165

By

Hughes, B.T.

**COASTAL WATER QUALITY SURROUNDING THE SITE FOR THE
PROPOSED FISHERIES JETTY, LAMI**

Batiri Thaman Hughes
Institute of Applied Sciences, August 2005

1.0 INTRODUCTION

The Institute of Applied Sciences of the University of the South Pacific was commissioned by Patricia Kailola to undertake an assessment of coastal water quality of the proposed site for the construction of a jetty by the Department of Fisheries at the old jetty site in Lami. The assessment provides baseline information on the coastal water quality which can be used to guide planning of the development and against which future changes may be monitored. The study team comprised of Sereana Kubuabola and Batiri Thaman Hughes of IAS. Two water quality monitorings (one whilst the fishing boats were still at the jetty and one when the fishing boats had left) were carried out to determine baseline coastal water quality at the proposed site.

The first monitoring was carried out on the 9th of March, 2005 on the outgoing tide. The weather was overcast with cloud cover around 70%. The second monitoring was carried out on 20th of July, 2005 again on the outgoing tide and in wet weather. Cloud cover was around 98%. Water conditions were rough and choppy.

2.0 PROPOSED DEVELOPMENT

The site of the proposed fisheries jetty is located to the north west of Suva Harbour within Nubulekaleka Bay. It is located just past the Tradewinds Hotels as you go towards Nadi along the Queens Road where the existing Fisheries Jetty is located.

3.0 WATER QUALITY SITES

Four sites were sampled. Details are described below and shown in Figure 1. Site 1 and 2 would indicate water quality directly adjacent to the existing jetty and the Tradewinds Hotel whilst Sites 3 and 4 are other sites for comparison with Site 4 being further offshore.

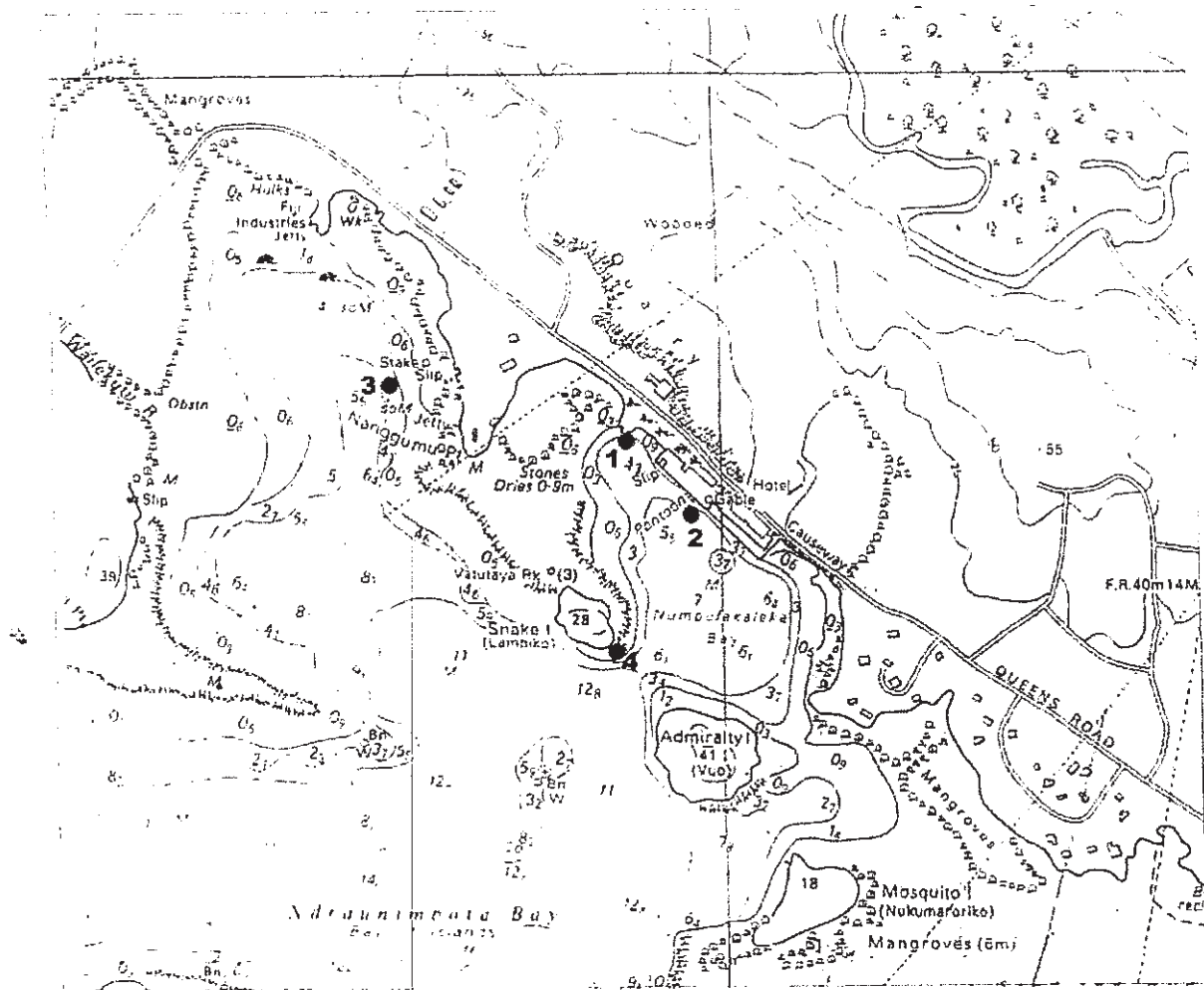
Site 1: Located directly off the south east end of the existing Fisheries jetty. Depth of around 5 meters

Site 2: Located off the south end of the pontoon with the restaurant at the Tradewinds Hotel. Depth of 3.3 m. .

Site 3: Located around Naqumu Point, offshore from Fiji Industries Jetty. Depth around 5 meters.

Site 4: Located between Labiko Island and Vuo Island. Depth 2 meters.

Figure 1. Water quality sites at proposed fisheries jetty site



4.0 WATER QUALITY METHODS

A boat was used to undertake the water sampling. At each site, the GPS location and a description of the site were noted. On-site measurements for water temperature, dissolved oxygen, and salinity were undertaken just below the surface (about 30 cm depth) using a Horiba multimeter. Clarity and depth were also measured at each site using a Secchi disc. A water sample was collected in bottles from the surface at each site for analysis in the IAS laboratory. Parameters analysed in the lab were ph, total suspended solids (TSS), faecal coliforms, and oil and grease.

5.0 WATER QUALITY RESULTS

Results for the water quality sampling undertaken whilst the boats were berthed at the jetty (during overcast conditions) and when they had left (wet conditions) are tabulated below.

Table 1. Water quality results for sampling whilst boats were still at jetty (March 2005)

Site	Location	GPS Position	Time	Temp (°C)	pH	DO (mg/L)	Salinity (ppt)	Clarity (m)	TSS (mg/L)	Faecal coliform (c/100mL)	Oil & grease (mg/L)	Comments
1	Off south east end of Fisheries old jetty	18o06 29S 178o23 42 E	9:05	29.5	8.1	4.8	22.2	1.75	12	25.5 x 10 ³	<2	5 m depth
2	Off tradewinds hotel. South end of-pontoon	18o06 29 S 178o 23 44 E	9:30	29.6	8.0	5.1	21.4	2	15	14.3 x 10 ³	<2	3.3 depth. Partly sunny.
3	Around Naqumu point between point and Fiji Industries jetty	18o 06 24 S 178 23 29 E	9:50	29.3	7.8	5.2	16	1.5	10	6.3 x 10 ²	<2	5 m depth
4	Between Labiko Island and Vuo Island	18o06 37 S 178o 23' 43 E	9:35 am	29.3	8.0	5.2	17.5	1.8	13	4.9 x 10 ³	<2	2
	Guidelines			20-30 ***	8.0-8.4 ** 7.7-8.5*	>6 (AA waters) >4.5 (B waters)*	30-35	>1.2*	<20(AA waters) <40 (B waters)****	<150 (recreation)*** <230 (AA waters)* <400 (B waters) *	No slick on surface*	

*Fiji Draft Sustainable Development Bill 1996- specific criteria for Class AA (Coastal Waters for Support of Marine Life) and Class B (Port Use)

**ANZECC (Australia and New Zealand Environment and Conservation Council (1992)

*** ANZECC (Australia and New Zealand Environment and Conservation Council) (2000)

**** Naidu and Morrison (1988)

Table 2. Water quality results for sampling when boats had left (July 2005).

Site	Location	GPS Position	Time	Temp (°C)	pH	DO (mg/L)	Salinity (ppt)	Clarity (m)	TSS (mg/L)	Faecal coliform (c/100mL)	Oil & grease (mg/L)	Comments
1	Off south east end of Fisheries old jetty	18o 06 28.37 178o 23 41.49	10:02 am	25.8	8.21	6.32	34.7	3	42	1100	<2	Organic matter in water (leaves). Very choppy
2	Off tradewinds hotel. South end of pontoon	18o 06 30.67 178o 23 44.68	10:15	25.9	8.23	6.72	35.3	2	13	70	<2	
3	Around Naqumu point	18o 06 24.57 178o 23 26.77	10:30	25.2	8.15	6.29	33.1	1.5	19	1800	8	Very choppy and turbid
4	Between Labiko Island and Vuo Island	18o 06 37.94 178o 23 40.63	10:45	25.9	8.20	6.79	35.2	2.5	20	110	<2	
	Guidelines			20-30 ***	8.0-8.4 ** 7.7-8.5*	>6 (AA waters) >4.5 (B waters)*	30-35	>1.2*	<20 (AA waters) <40 (B waters)****	<150 (recreation)*** <230 (AA waters) <400 (B waters)*	No slick on surface	

*Fiji Draft Sustainable Development Bill 1996- specific criteria for Class AA (Coastal Waters for Support of Marine Life) and Class B (Port Use)

**ANZECC (Australia and New Zealand Environment and Conservation Council (1992)

*** ANZECC (Australia and New Zealand Environment and Conservation Council) (2000)

**** Naidu and Morrison (1998)

Temperature at the four sites ranged from 29 to 30 degrees Celsius during the first sampling and from 25 to 26 degrees Celsius during the second sampling. These were all within the recommended temperature for marine water which is 20 to 30 degrees Celsius.

Salinity ranged from 16 to 22.2 ppt at the four sites during the first sampling, which indicates high freshwater input and between 33 and 35.2 ppt during the second. The results of the second sampling fell within the expected range of salinity in marine water which is 30 to 35 ppt.

Dissolved oxygen was between 4.8 and 5.2 mg/L at all sites during the first sampling with the lowest value being at Site 1 (Existing jetty). This is acceptable for waters to be used as a port (>4.5 mg/L) but not for the support of marine life. Levels ranged between 6.29 and 6.79 mg/L during the second sampling and were all above the recommended level of 6 mg/L for coastal waters to support marine life. This indicates good circulation within the bay.

The pH ranged from 7.8 to 8.1 during the first sampling. All sites except Site 3 (Around Naqumu Point) were within the acceptable range of 8.0-8.4. The pH during the second sampling ranged from 8.15 to 8.23.

Clarity during the first sampling was satisfactory, ranging from 1.5 to 2 meters thus just above the minimum requirement of more than 1.2 meters. Clarity during the second sampling ranged from 1.5 to 3 meters again being the lowest at Site 3 (Naqumu Point). This was evident in the water being turbid at this site.

Total suspended solids (TSS) which is related to clarity as it measures the amount of suspended matter in the water was at low levels (between 10 mg/L and 15 mg/L), during the first sampling. It is recommended that it is below 20 mg/L to support marine life. During the second sampling, levels were slightly higher (13 to 42 mg/L) with the highest level recorded at Site 1 (jetty) where it was 42 mg/L. Total suspended solids and clarity are a measure of how clear the water is. This is important for survival of marine organisms as increased silt may clog feeding and respiratory structures of coral and marine animals, reduce photosynthesis by reducing light penetration into the water column and smother organisms.

Oil and grease was detected in the lab analysis only at Site 3 during the second sampling (mg/L), however no oil slick was seen. It is possible that the oil maybe from the fishing boats and other boats that use the jetties around Naqumu point.

Faecal coliform levels ranged from 630 to 255,000 counts/100ml during the first sampling with very high levels recorded at Site 1 (jetty) and Site 2 (Tradewinds hotel) and all levels being above the maximum recommended level for port waters of 400 counts/100mL. Levels ranged from 70 to 1800 counts/100mL during the second sampling with high levels recorded at Sites 1 (jetty) and 3 (Around Naqumu Point). The measurement of faecal coliforms indicates the degree of pollution of water from animal or human faeces or sewage and which if present at high levels could be health hazard for use of waters for swimming or for harvest of shellfish for consumption.

6.0 Discussion and Proposed Impacts of Jetty on Coastal Water Quality

The current status of water quality at the proposed site for the development of the new Fisheries Jetty is quite poor. Although it meets the acceptable guidelines for port waters for most parameters (pH, dissolved oxygen, Total Suspended Solids and clarity), faecal coliform levels indicate that the coastal waters are fairly polluted and could be a hazard to health if residents are swimming and gleaning marine organisms from the mudflats to eat. In addition, the levels of dissolved oxygen and clarity during the first sampling bordered the minimum acceptable level.

To summarise the results, temperature, salinity and pH were within the recommended guidelines for marine coastal waters at all four sites for both sampling times. Clarity (1.5-2m) during the first sampling was within acceptable limits (> 1.2 m) but still fairly poor. It increased slightly during the second sampling even though the weather was rainy. At the jetty this could be because of less boats moored there. At Site 3 (Around Naqumu Point) the poor clarity is probably a result of the site being less protected and thus high wave action. Dissolved oxygen levels were surprisingly low during the first sampling but were at acceptable levels during the second sampling. Total suspended solid levels were all within acceptable levels except at Site 1 (jetty) during the second monitoring. Oil and grease was only detected at Site 3 (Around Naqumu Point) during the second sampling, however oil slicks were observed on the surface at Site 1 (near jetty) during the first sampling. There was not a lot of variation in water quality between when the boats were at the jetty and when they were not.

The only parameter of concern was the high faecal coliform levels at all sites except for Sites 2 and 4 during the second sampling. This indicates sewage pollution and could be from the existing jetties in the area, wastewater from the Tradewinds Hotel which, seepage from septic tanks of coastal residents and fishing boats moored offshore. This could be a health hazard particularly since the bay is used for recreation such as swimming and canoeing and the mudflats by local residents gleaning for marine organisms.

The key impacts that the proposed construction and operation of a commercial jetty may have on coastal water quality and recommended mitigating measures include the following:

During construction:

<i>Potential Impact</i>	<i>Mitigation Measure/Recommendations</i>
1. Increased turbidity due to suspension of silt from the drilling of piles and other structures.	<ul style="list-style-type: none"> • Silt curtains or fences around to localize effect. • Undertake monitoring during and post construction
2. Improper disposal of solid and liquid waste from construction workers resulting in increased levels of nutrients and/or faecal coliforms.	<ul style="list-style-type: none"> • Ensure proper facilities are provided for disposal of rubbish and sewage effluent by construction workers. • Collecting construction debris and disposing of it in a suitable, approved disposal site.

During operation:

<i>Potential Impact</i>	<i>Mitigation Measures (ADB 1993)</i>
1. Increased turbidity as a result of vessels visiting the jetty stirring up sediment on the seabed	<ul style="list-style-type: none"> • Requiring vessels to slow down on approach to jetty
2. Increase in nutrients and faecal coliforms from the inappropriate discharge of sewage and other liquid waste from ships and jetty facilities	<ul style="list-style-type: none"> • Ensure proper waste management facilities for ships and at jetty • Prohibit the discharge of ship sewerage while berthed offshore • Monitor water quality around the area on a regular basis.
3. Spillages of oil and fuel from boat operations and jetty fuel storage facilities	<ul style="list-style-type: none"> • Maintaining port areas in a clean condition to prevent oil being carried into the water by stormwater discharges • Ensure routine emergency control of oil spills exist

The water quality results presented serve as a baseline against which future water quality can be compared against. It should be noted that because water quality is already fairly poor in the area around the proposed jetty, actions such as the mitigative measures mentioned above should be taken to prevent further deterioration or to improve water quality during the construction and operation of the jetty in order to protect human uses of the area such as harvest of fisheries, swimming and paddling and its aesthetics.

7.0 REFERENCES

Asian Development Bank (1993). *Environmental Guidelines for Coastal Zone Development Projects*.

Australian and New Zealand Environment and Conservation Council. 1992. *National water quality management strategy, Australian water quality guidelines for fresh and marine waters*, ANZECC, Australia.

ANZECC (2000). Australian and New Zealand guidelines for fresh and marine water quality. Australian and New Zealand Environment and Conservation Council.

Fiji's Draft Sustainable Development Bill. 1996. Government of Fiji.

Morrison, R.J., Dixon, B., and Sharma, P. 1989. *Environmental Survey into Possible Pollution Caused by Lami Dump*. IAS Environmental Studies Report C43. IAS, USP.

Naidu, S.D. and Morrison, R.J. 1988. *Development of Effluent and Waste Disposal Standards for South Pacific Island Countries*. INR Technical Report No. 88/3.

Naidu, S., Aalbersberg, W., Brodie, J.E., Fuavao, J.E., Fuavao, V.A., Maata, M., Naqasima, M., Whippy, P., Morrison, R.J. 1989. *Water Quality Studies on Selected South Pacific Lagoons*. INR Report 89.

Naidu, S. and Morrison, R.J. 1994. Contamination of Suva Harbour, Fiji. *Marine Pollution Bulletin* 29 (1-3):126-130.

Tamata, B., Lloyd, C., and Green, D. 1993. *Water Quality in the Ports of Fiji 1992 Monitoring Programme*. IAS Environmental Report No.67. Institute of Applied Sciences, USP, Suva

Tamata, B. and Thaman, B. 2001. *Water Quality in the Ports of Fiji – Survey of Various Ports and Industrial Point Sources of Pollution*. IAS Environment Studies Report C103. IAS, USP, Suva.

Aerial Photo of Proposed Site for Fisheries Jetty and Adjacent Areas

