NATIONAL FISHERIES AUTHORITY

*Site of the proposed boat harbour near the Main Market, Alotau*

# Environmental Assessment
# (Level 1 Activity)

## Construction of small boat basin and wharf facilities, Alotau, Milne Bay Province

*Prepared by the*
Project Implementation Unit
of the National Fisheries Authority's
Coastal Fisheries Management and Development Project

PNG NATIONAL FISHERIES AUTHORITY
COASTAL FISHERIES
Management and Development Project
ASIAN DEVELOPMENT BANK

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## Contents

# 1. INTRODUCTION

## 1.1 Purpose

The purpose of this report is to present the findings of an Environmental Impact Assessment (EIA) for the proposed development of a small boat basin and wharf facilities adjacent to the Main Market in Alotau, Milne Bay Province. Construction of the facilities is a component of the PNG Coastal Fisheries Management and Development Project (CFMDP), a program being implemented by the National Fisheries Authority with loan funding provided to Papua New Guinea by the Asian Development Bank. The overall aim of CFMDP is to contribute to the reduction of poverty in rural areas through increasing, or preventing a further decline in the incomes of coastal communities. This will be done by promoting improved management of resources and by creating sustainable earning and employment opportunities for coastal communities, including through the construction of wharves and jetties and other social infrastructure.

This project comprises an approximately semi-circular breakwater designed to provide shelter and mooring space for small boats within its confines, and wharf facilities for larger boats on the outside of the structure. Its proposed location is on the shores of Sanderson Bay close to the existing Huhu Main Market and the business centre of Alotau. The small boat basin encloses a space which includes approximately of 90m of the shoreline and extends up to 70m out into the bay. The facility will cater for up to 20 village boats of under 10m length.

The PNG Constitution identifies protection and wise use of the natural environment as a foundation of the country's development. The main Acts of Parliament and Regulations that control the way the environment is managed are: the Environment Act 2000, Amendment 2002 and Environmental Regulations 2002 implemented through the Department of Environment and Conservation (DEC), as well as the National Cultural Properties Act (1974) which is implemented through the National Museum. Several other Acts relating to natural environments, agriculture, health, occupational safety, labour and welfare are also relevant.

We believe that this project would be considered a Level 1 Activity under the Environment Act 2000 and the Environment (Prescribed Activities) Regulation 2002 and would therefore not require a permit. This Environmental Impact Assessment has been prepared with the aim of ensuring that the project contributes to the sustainable development of the Alotau area and Papua New Guinea as a whole.

## 1.2 Methods and approach

This EIA is based on site investigations carried out by Dr Ursula Kaly, the CFMDP's Environment and Monitoring Adviser, on 23 July and 15-16 November 2004. Initial investigations were also undertaken near the project site in August-September 2001 by John Carter who consulted with intended project beneficiaries, to investigate relevance of the project. Between 16-20 November 2004, an additional survey of boat operators was undertaken by Mr John Aini, CFMDP's Data Management Specialist, to determine likely use and willingness to pay for the new facilities.

This environmental assessment was undertaken in accordance with the Asian Development Bank's Guidelines for Environmental Assessments and for Selected Infrastructure Projects (Ports & Harbours) (ADB, 1993, 1998). The approach taken included field investigations, interviews with stakeholders and other surveys as well as reviews of previous documentation, and interpretation of charts and aerial

photographs of prospective sites. A key feature of the process was that the environmental specialist worked closely with the project engineer to ensure that the project design reflected environmental sensitivities and the need for social benefits wherever possible. This was done through several iterations of consultation and design modifications.

## 1.3 Setting

Alotau is the administrative and business centre Milne Bay Province which includes mainland areas and the many islands off the south-eastern tip of Papua New Guinea. Sanderson Harbour and the areas immediately to its south function as the main location for port activities, but the main market and business centres for the town are located further to the west and slightly inland (Figure 1).

Figure 1: Aerial photograph showing location of the proposed project.
Shown are the locations of the Central Business District (CBD), the Main (Huhu) Market, Sanderson Harbour, and the location of the proposed new Jetty Basin. This map is based on a 1987 aerial photograph.


Over the last 15 years there has been extensive development of infrastructure around Sanderson Harbour, and only limited developments elsewhere along the shorelines of the town. Sanderson Harbour is the only protected anchorage in the immediate area of the town and has become very congested. It comprises a natural embayment of about 0.04 $km^2$, where there is a concentration of dinghies, village boats, and larger transport vessels which in peak periods are often rafted on to each other. The harbour itself is heavily polluted, and is receiving sewage and sediment inputs via waterways that run through land clearances upstream.

The objective of the proposed project is to improve facilities for access by small and larger boats to Alotau, its markets and business centre, and to alleviate some of the congestion and pressure on Sanderson Harbour for small boat operators and the passengers they carry. These improvements are expected to particularly benefit small boat owners and provide social benefits in optimising the link-ups between sellers from the islands and transportation services in Alotau.

The climate in the area is tropical, with coastal temperature ranges of 20-37ºC and moderate to heavy rainfall. The mean annual rainfall in the area is between 1500-5000mm, being heaviest between April and October on SE areas of Normanby Island and Milne Bay (Smith & Davies 1973). The north coasts are drier and receive most of their rainfall between November and March. Rainforest covers most of the area,

though there are some grasslands along the north coast of the mainland, and mangrove areas on parts of the coastline.

The mainland area around Alotau is dominated by northern and southern mountain blocks, separated by a depression extending from Mullins Harbour to Milne Bay. The maximum elevation in the northern mountains is about 1550m, SW of Cape Frere, and in the southern block 1350m at Mount Suau. The seas are generally shallow (<200m) with scattered coral reefs. There are steep-sided sea-floor depressions in Milne Bay (500m). Three main rivers flow into Milne Bay, the Maiwara, Gumini and Dawa Dawa Rivers. The geology of the area is dominated by submarine basic volcanics (Kutu Volcanics[1]) which forms much of the mountainous areas to the immediate north of Alotau. The coasts and head of Milne Bay, including the shores of Alotau are composed of alluvium and beach deposits[2] of gravel, sand, silt and clay. Milne Bay is a graben[3] structure which developed during Pliocene-Quaternary[4] time (Smith & Davies 1973).

### 1.4 Existing infrastructure

The area nominated for the proposed project is located on the shoreline of Milne Bay approximately 1km west of Sanderson Harbour. The adjacent land (about 200 x 250m) is a vacant grassed area, with few trees and has several informal road tracks leading to the shoreline. The Alotau Main Market is located near the Abel Highway on the western part of the site. There is currently a small wooden piled, wooden-decked jetty at the site of the proposed project. In July 2004 this was derelict, but by the time of the second site visit in November, it had been refurbished for a canoe festival. In the week following this site visit, the jetty was damaged by heavy rains.

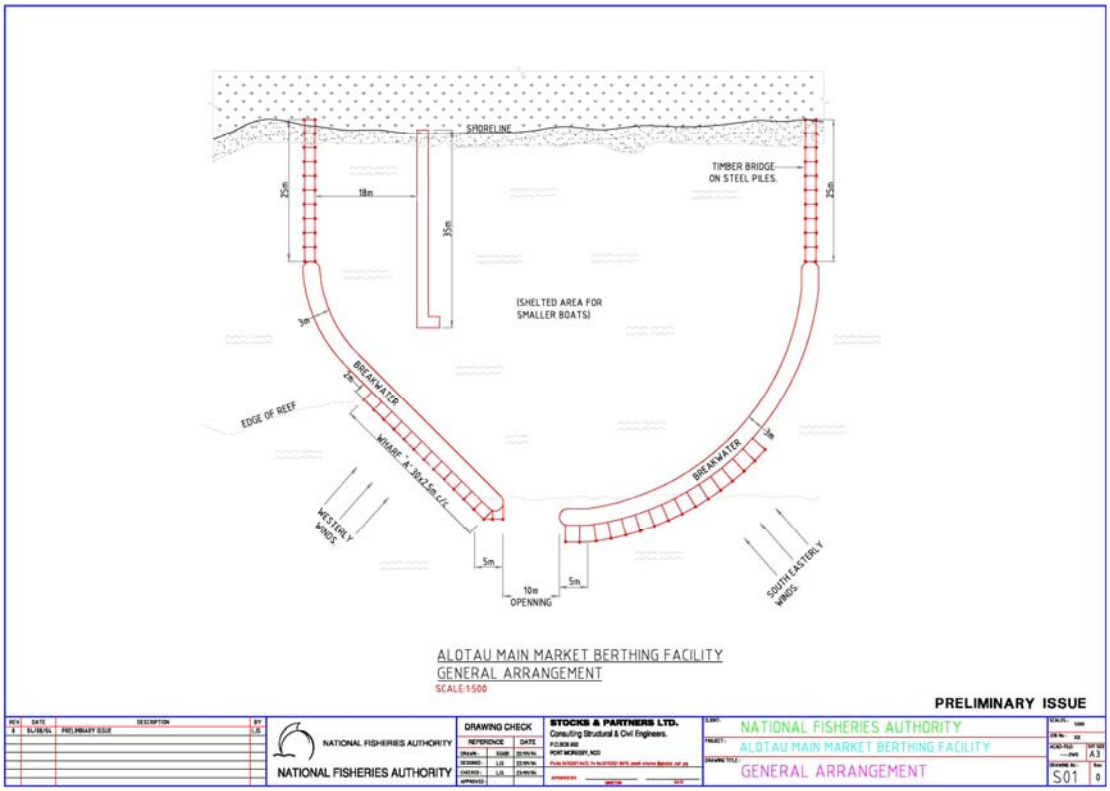
## 2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The project involves construction of a harbour basin on the shore of Milne Bay immediately to the south of the Alotau Main (Huhu) Market (Figure 1). The harbour is designed to provide shore access for small and larger boats, and protection with anchorage for small boats (Figure 2). The structure comprises a breakwater with a small entrance which has been curved to attenuate waves and minimize their impacts on the structure itself and the surrounding environments. Two piled wharf areas are provided on the outside wall for use by larger boats for short term berthing and loading/unloading. Two wharf areas have been provided in the design to ensure that at least one is always available during rough seas. The inside of the harbour basin has been designed for short to longer term use by small banana boats. The breakwater is to be provided with access and tethering structures along its inside face to allow people to tie their boats and access the breakwater to go to shore. It is envisaged that small boats could either tie-up along the breakwater, beach for maintenance or anchor safely within the basin. Access to the shore is provided for both inside and outside facilities along two piled jetty sections that connect the main breakwaters with the shore. The shoreline end of the basin has been deliberately left open to encourage water circulation (and ensure good water quality), and to allow for shoreline processes to continue (wave attenuation to dampen waves that with a solid shoreline structure could bounce back into the basin resulting in small standing waves) (Figure 2). The shape and location of the basin include consideration for water depth and the presence of coral reefs in the area.

[1] The submarine basic volcanics are of Middle Eocene age = 45-49 million years before present
[2] In the project area these are mostly river and beach sands and gravels of Quaternary age
[3] A graben is a block-like area that has subsided between fault lines
[4] Pilocene = 1.85-5.5 million years before present

The harbour basin and wharf structure is designed to improve links between fish sellers, the main market, and potential markets at the palm oil plantations in the area. It is also intended to provide access for the cruise ship passengers who are expected in Alotau (4-12 ships per year, in previous years) and a co-ordination point for passengers who want to arrange transport to the outer islands. The Milne Bay Administration has set the area aside for integrated development that will include a cultural centre, townhall, tourism facilities and a new market. This project has been designed to complement and interface with the new market facilities being proposed with assistance from the AusAID Incentive Fund.

Figure 2: General layout of the proposed harbour basin.




## 3. Description of the Environment

### 3.1 Physical resources

Alotau is located on the northern side of Milne Bay and covers an area of about 5 square kilometres along the shore and in the surrounding foothills centred on Sanderson Bay. Most of the residential part of the town is located in the steep volcanic hills surrounding the shores of the bay and Sanderson Harbour areas, while the businesses and other commercial activities are located along the Abel Highway. The town is situated partly on volcanic bedrock, and partly on alluvial gravel and sand deposits which forms a very narrow plain between the hills and the shore (only about 200-300 metres wide).

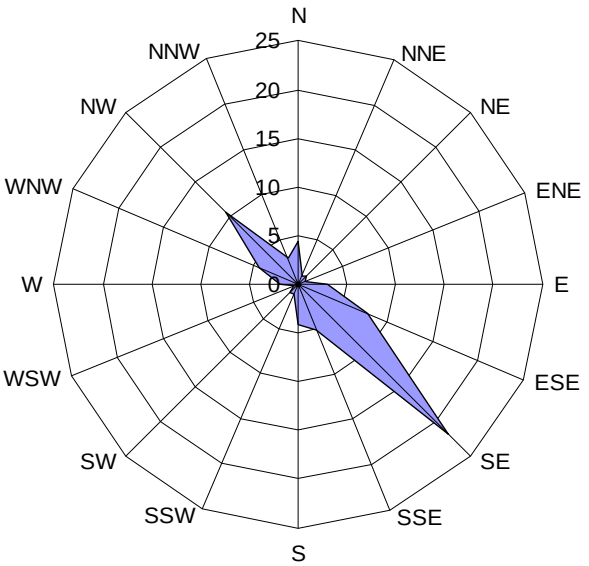
Freshwater discharge in the area appears to be limited, but may be occurring through the highly porous alluvial soils and several small creeks that run towards the bay. One creek, Waduwadu, is located immediately to the west of the site of the proposed development. It is in moderately good condition, showing little evidence of heavy sewage contamination (no signs of oxygen depletion or algal overgrowth), but has

been damaged by the presence of a market rubbish dump on its shores about 200m upstream from its mouth. Waste plastics and other materials have accumulated at its mouth and offshore in the shallow marine environment.

The shoreline in this area is composed of alluvial gravels and sands derived from the dark volcanic rocks eroded from the surrounding hills. In general, the shore in this area is subject to low-moderate wave energy, with winds building waves across Milne Bay. There is no measurable longshore transport of sediments in the area. About 500m to the east, at the site of the Alotau International Hotel, a seawall built out perpendicular to the shoreline has had no accumulation of sands on either side of its structure that would indicate any significant movements of sand to the east or west.

We were unable to obtain wind speed records for Milne Bay, but show in Figure 3 the general patterns for Lae (and which in terms of seasonal patterns are similar to Port Moresby and other areas in SE PNG). The site is generally exposed to the predominant SE wind direction, but according to locals also receives winds from the W and SW. It is likely that the SE corner of Sanderson Bay offers some protection to the site from swells approaching the east, but these are also likely to be refracted by the point, wrapping around it to approach more directly. The entire coast along the northern side of Milne Bay is being slowly eroded by the predominant wind / wave conditions, with erosive forces being counteracted partially by inputs of alluvial materials from rivers and creeks. The wind /wave climate of the site makes use of the area by boats without the protection that the proposed development will offer difficult for a significant part of the year.

Figure 3: Total percent of hourly wind observations from WMO data for Lae, Morobe Province.
Data are from NOAA International Station Meteorological climate summary Version 4.0 September 1996.




Water depths in the vicinity of the proposed project increase gradually from the shoreline to a drop-off about 60m offshore where the depth drops rapidly. This pattern continues along much of the coastline for several km in either direction, being

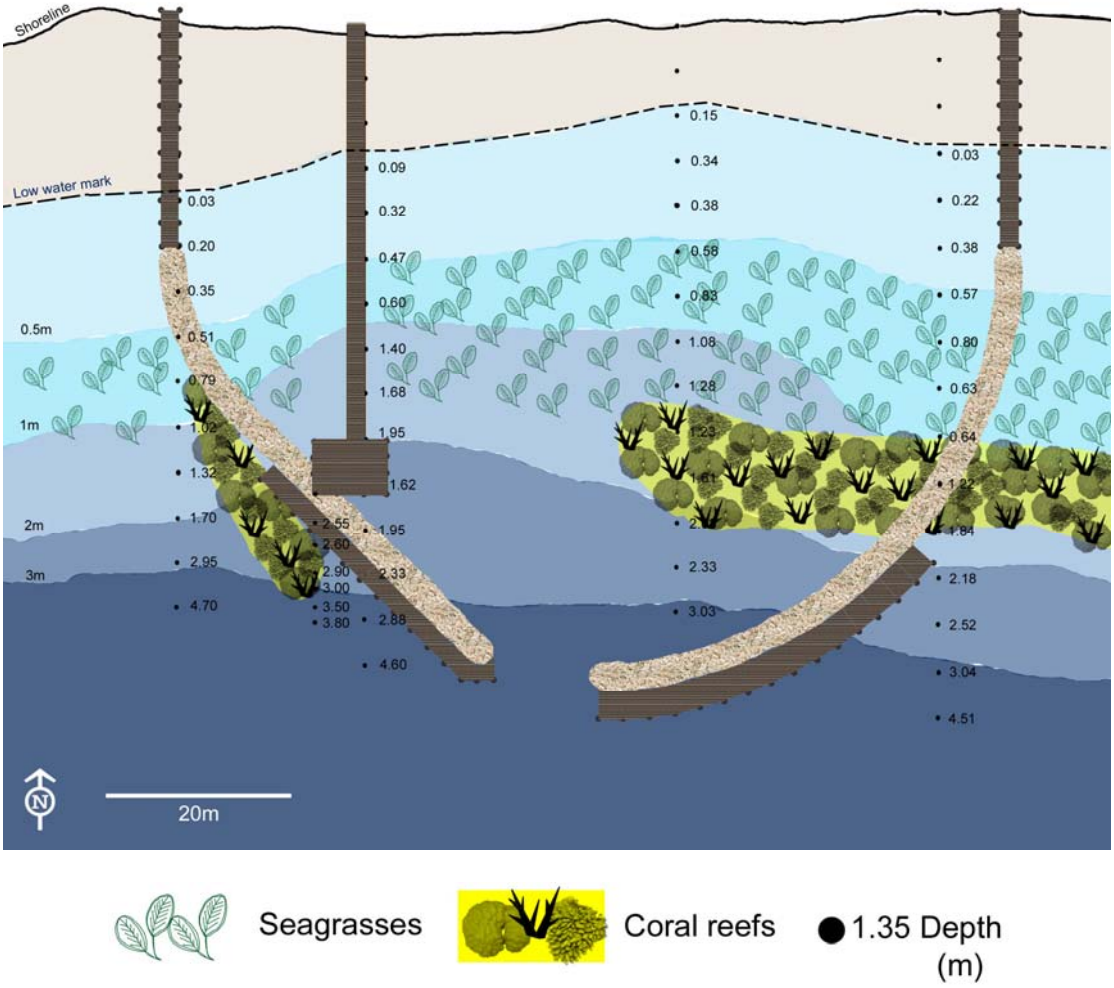
interrupted only where creeks enter the sea. At these sites small alluvial fans are often formed. Anoxic sediments were not observed anywhere around the project site. There does not appear to be any problem with water quality, clarity or sewage loading in the area, and no problems with oil sheens or algal blooms were observed. Rubbish (alcohol bottles, cans, scrap metal, plastics) were found to have accumulated in the area of the existing small jetty at the site.

## 3.2 Ecological resources

The terrestrial areas adjacent to the site of the proposed project have been highly modified by past clearing, and construction of an old shoreline road. Vegetation is limited to grass in the area between the shore and Abel Highway (crossed by footpaths and track roads), several coconuts and several other trees (a large fig, and one broadleaf rainforest tree). Most of the remaining vegetation is secondary regrowth, and most of that is present around Waduwadu creek. The few remaining trees in the area are an attractive feature providing shade and some foreshore stabilisation and need to be preserved. Additional plantings of trees along the shoreline would improve the site. There are no terrestrial habitats of importance to wildlife around the site and no mangroves nearby.

The shallow marine area at the site and stretching for several kilometres west, and east to the site of the Alotau International Hotel and western limit of Sanderson Harbour support discontinuous fringing reefs and seagrass areas (Figure 4). At the proposed site, these communities are in very good condition, with no evidence of disease, bleaching or excess mucus production in corals. Coral cover in the small coral reef areas averages 35%. The seagrass areas were also observed to be in good condition, with healthy areas of at least 5 species of seagrasses (*Thalassia*, *Halodule*, *Halophila*, *Syringodium* and some *Enhalus*) and cover an average of 34% of the sea floor. The areas not covered by seagrasses or coral reefs are mostly sandy, with small individual corals that have attached to stones or other materials. A wide variety of reef fishes was observed using the area, though no fishes larger than 25-30cm were observed during the site investigations.

Figure 4: General; layout of the physical and ecological conditions found at the site of the proposed project.
The distribution of seagrasses and coral reefs is shown in relation to the proposed development, existing wooden jetty and depth information in metres at low tide on 16th November 2004. Blue shading has been used to show depth contours at 0.5, 1, 2 and 3m.

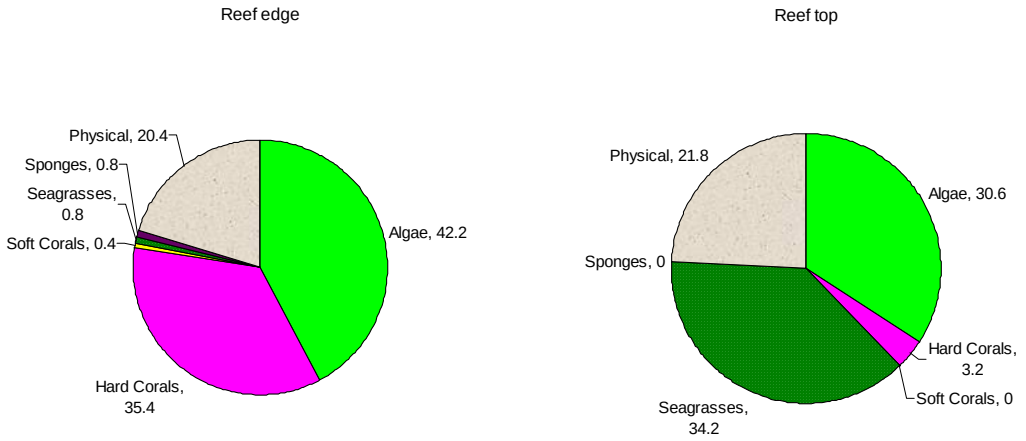




Seagrasses

Coral reefs
● 1.35 Depth (m)

Figure 5: Percent cover by coral and seagrasses at the reef edge (1-2m depth) and reef top (<1m depth) habitats at the site of the proposed project.
Categories are: (i) Physical features (sand, rubble, rock); (ii) Algae (includes *Sargassum*, Coralline algae, *Turbinaria*, mixed turf and others); (iii) Hard corals (includes *Acropora*, *Porites*, Faviids, Mussids, *Goniopora*, *Hydnophora*, *Millepora*, *Pavona* and *Fungia* species); (iv) Soft corals; (v) Seagrasses (includes *Thalassia*, *Halodule*, *Halophila*, *Syringodium*, and *Enhalus*); and (vi) Sponges. Data are mean % cover estimated using 100 point intercepts on 5 replicate 30m transects.




## 3.3 Human and economic development

Alotau is a small town with an urban population of about 10,000 (in the year 2000). It serves as a commercial hub (located not far from Gurney airport) for another 6,000 - 8,000 people who work on the oil palm plantations to the west, and for the population of more than 150,000 people who live on the 210 islands of Milne Bay Province. It has a very pleasant setting (tucked in the foothills around Sanderson Bay) and has much less of a law and order problem than most of the other provinces (according to the Provincial Profiles).

Sanderson Harbour serves as a transit area for dinghies and village boats and is extremely congested much of the time. Larger vessels and the bulk fuel carrier use the large Harbours Board wharf on the western headland near the entrance to Sanderson Harbour. The village boats which move passengers and goods between the islands and Alotau mostly use the east side of the harbour, near the Masurina Business Group facilities, though some do use the existing wooden jetty recently refurbished at the site of the proposed project. The fisheries and export businesses (Nako Fisheries, Kiwali Exports, AsiaPac Pty Ltd., and Chao Enterprises) are located beyond the entrance to Sanderson Harbour, further south along the shore of Sanderson Bay. The whole of Sanderson Bay falls within the authority of Harbours Board, which is supposed to collect fees for the use of facilities; however, it appears that no fees are collected. There is clearly a need for expansion of facilities into other parts of the area if the centre is to continue to develop.

The main market and business centres for Alotau are located inland from the proposed project site, some 1km from Sanderson Harbour where most of the vessel traffic is centred. The large distance between the two centres probably makes the transfer of passengers and goods difficult between the main transport and business centres.

There is an overseas wharf about 700 meters south of Sanderson Bay, which serves the larger vessels, including passenger cruise ships. Twelve of these ships visited Alotau in 1999. Four arrived in 2000, and one in 2001; however, the local tourism authority expects the number of cruise ships to increase in the future. Each of these ships brings about 1,000 passengers who spend a day in Alotau. They transit via the overseas wharf and have to walk through town. They could be shuttled from the overseas wharf to the main market / business area if facilities were available there.

In 1992 a foreshore land-use plan was developed for the whole of Sanderson Bay and the area to the west. The plan is very ambitious and projects an up-scale recreational and tourist-type setting, with floating restaurants, saltwater pool, seafood restaurants and shopping mall, shower and toilet facilities, relocation of the existing fuel depot, and relocation of the squatter settlements. The only part of the 1992 plan that has been realized is construction of about 80 meters of concrete wharf along the west side of Sanderson Bay. Several hotels and guest houses are established in the area of Alotau, with the Alotau International Hotel about ½ way between the project site and Sanderson Harbour.

During the original site survey in August, 2001, Sanderson Harbour was extremely busy. Sixty boats were counted in the harbour, ranging from dinghies to village boats to 15-meter transports. Most of the wharf frontage was taken up and there was little room left for anchoring vessels in the harbour. Approximately 500 people were using Sanderson Harbour in one manner or another, either on the boats, in the market on the east side of the harbour, or resting on the beach. Apparently Sanderson Harbour is even busier than this during the Christmas season.

Most of the people coming to Alotau are from the islands (Basilaki, Engineer Group, Barabara, Kurada, Normanby Island, Purada, Bunama, and Kitai Island). A few come from other villages on the mainland. They travel to Alotau to sell products from their villages (fresh fish, smoked fish, shellfish, yams, coconuts, betel nuts, baskets, mats), to pick up supplies (rice, flour, salt, sugar, corned beef, canned tuna, soft drinks, twisties, crackers, cookies, bleach, soap, kerosene, wood planks – in one cargo that was examined), or to attend to administrative matters (see also Figures 6 and 7). At times, the islanders have sold beche-de-mer to the three or four buyers in Alotau (e.g. Nako Fisheries). There is difficulty in selling reef fish; in the past, these have been sold to the Government and stored at Fisheries, or sold at the main market. Fish that were observed at the main market included trevally, mackerel, kingfish, tuna, red emperor, and scads. Most of the people from the villages try to sell all their products at the main market. They may also try to sell to the hospital mess, the hotel, or occasionally directly to the palm oil plantations. Lack of ice reduces the quality and selling time for the fish. By 4 pm, if they have any goods left, they return to the informal market at Masurina and try to get rid of it all before heading home. The sellers try to minimize their time in Alotau, but most have to stay a minimum of 2-3 days, usually using the transit residence at Masurina.

Figure 6: Number of tables selling different products at the main market on 16th November 2004. The total number of tables surveyed was 406. These figures sum to more than this because many tables were selling more than one item. The category "other" includes dyes, fire wood, crafts, plastic bags, newspapers and jewellery.

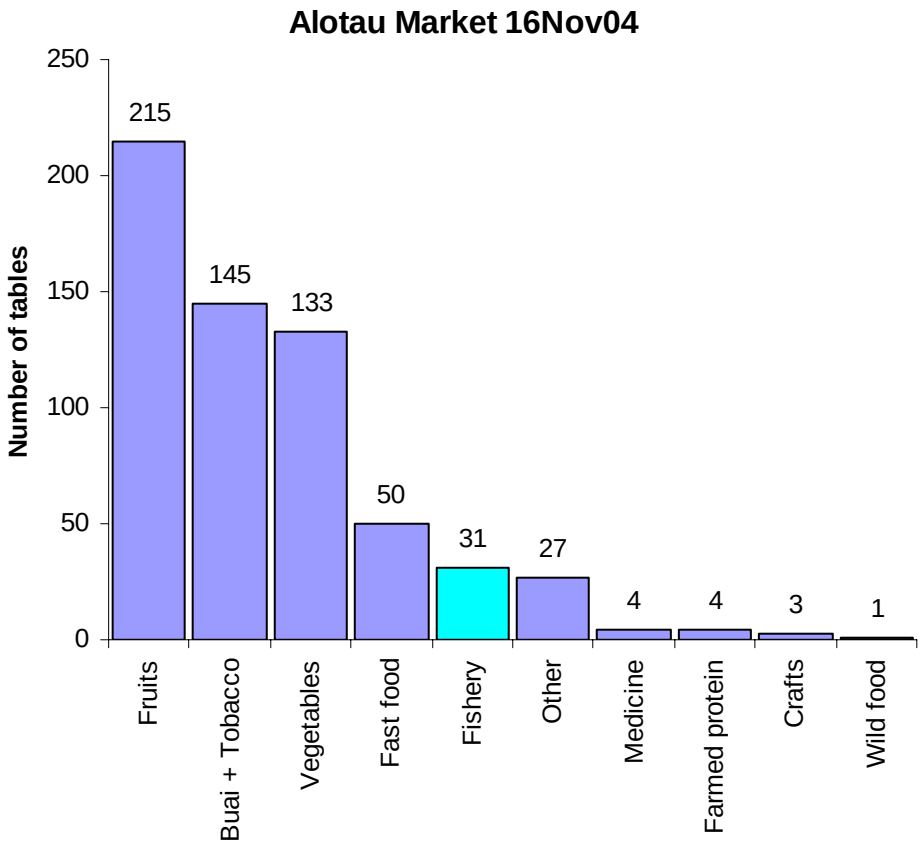
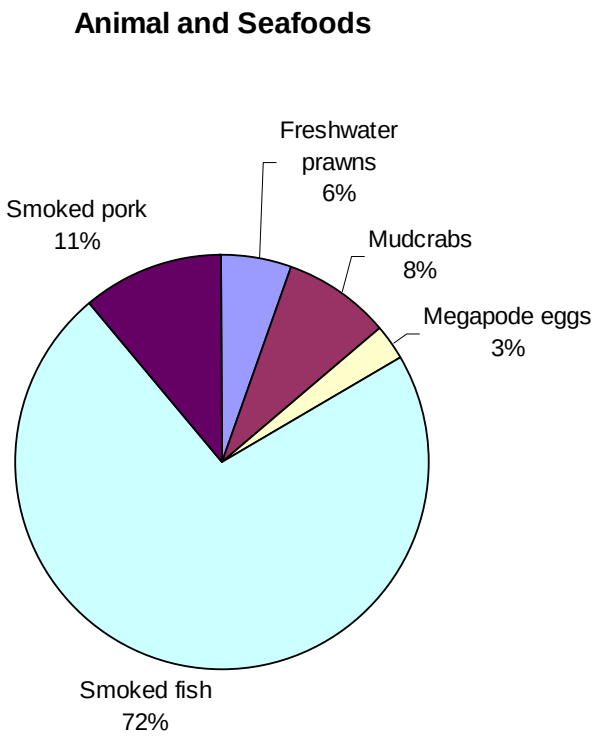


Figure 7: breakdown of types of animal protein foods available at Alotau Market on 16th November 2004.
Data are percent of tables offering each of the food types of a total of Fishery + Farmed + Wild food (36 tables in Figure 6 above). Most of the animal protein foods available on that day were smoked fishes which accounted for almost ¾ of what was on offer.




Most transporters try to make daylight trips only, so are anxious to leave well before dusk. Village transport boats may carry as many as 50-60 passengers, who must pay before boarding the vessel at their village. A typical boat fare is 13 kina for a one-way trip between Kitai Island and Alotau (this price has increased 30% in the last three years). Travel time for people going to Alotau generally ranges between 3-8 hours, with fares ranging between 4 and 20 kina per one-way trip. Dinghies are faster than the diesel village boats, so tend to be more expensive. While some villages on the mainland are served by transport on a daily basis, others, such as Kitai Island, only have access to Alotau once every 2-3 weeks.

## 3.4 Social issues

Social issues were determined during respondent surveys and observations at Sanderson Bay and the main market (see Appendix 2). Many of the social issues that respondents described are defined by larger economic factors, transportation inefficiencies, and conditions in their villages, rather than the conditions in Alotau. The following details pertain to the experience of people using the facilities and services in Sanderson Harbour, which might be improved with the proposed project by providing additional and alternative facilities closer to the main market and business and administrative centres. Many of these people are regular visitors to

Alotau. Some may split their time almost equally between their villages and marketing in Alotau. Others operate the village transport vessels almost full time.

Sanderson Harbour has some basic facilities provided (such as temporary shelter, water, toilets). Most of the problems described by respondents stem from the overuse and poor maintenance of these facilities, and the lack of rationalization of the use of the harbour, or zoning of activities. The main issues raised by people during this survey were:

1. Unsanitary conditions. The toilets on the eastern side of the harbour do not function properly, posing a health risk.
2. Problems with temporary lodgings. Temporary lodgingsprovided by Masurina was originally intended for people visiting from the islands. Islanders now complain that the lodging area has been taken over by mainland women selling betel nut, and that they stay there for several weeks at a time. Many people sleep on their boats, because the lodging area at Masurina is too cramped.
3. Lack of incentives to use facilities efficiently. Because the facilities in Sanderson Harbour are provided for free, a "hand-out" mentality has been created that means people linger and do not automatically seek efficiencies in their time. Some of the boat operators complained about this problem and felt that they wasted a lot of time in Alotau, waiting for the sellers to complete their business (selling all their goods so they can afford the boat fare home).
4. Loss of profitability. Profitability has been squeezed for all concerned, with on-going increases in fuel prices over the past few years. The boat operators have tried to minimize their exposure by raising fares and collecting fares from passengers before they sail. They also load up the boats beyond safe limits in order to increase the profitability of their trips. The sellers, on the other hand, are pressured by the increased competition (for example, more people selling betel nut), the reduction in numbers of commercial buyers (for example, fewer places to sell fresh fish in Alotau), and temporary closures of the beche-de-mer fishery.
5. Large transport distances and lack of ice for fishermen. Many of the islanders cannot get fresh fish on ice to Alotau, because of lack of ice on the islands and very unreliable transportation. There is no cheap public transport between Sanderson Bay and the main market. Many walk with their goods, some a long way to get fuel. Several people suggested the need for fuel pumps closer to the harbour.
6. Poor drainage. Wet conditions occur on the east side of Sanderson Bay during the period January-April leading to further problems of sanitation.
7. Law and order. Although the general law and order situation is seen as good, there is some concern over possible theft of boats and harassment by drunks.
8. Cramped conditions in Sanderson Harbour. Boats have to tie up abreast, which requires crossing of boats by many people to get to the wharf. Several operators also complained about the fact that Nako boats have priority at the wharf, which pushes them out of the queue.
9. Health problems. These are not necessarily a function of the situation in Sanderson Harbour. Malaria was commonly mentioned, though diarrhoea and HIV/AIDS were also acknowledged as problems. Respondents associated the latter with younger women from the islands trying to raise cash on the mainland.

### 3.5 Boat usage and willingness to pay for facilities

The second social survey focusing on boat operators identified different usage patterns by owners of banana boats (19-24 ft with most engines running on zoom) and workboats (18-48 ft with diesel engines). The summary results presented below are based on 56 interviews, 29 with workboat operators, and 27 with the owners of banana boats.

Operators of workboats tended to come to Alotau once per week, usually to conduct business and to carry passengers and cargo, including market goods, copra and dry marine products. Some of these boats are being used for charters. They usually carry between 20 and 30 passengers, though the range is between 8 and 40. Many of the operators stay for 2-3 days (range 1-5 days), living on their boat during their time in Alotau, most with the boat in Sanderson Harbour. Few of the workboat operators make the trip exclusively to buy or sell fish. The main products they do bring are fresh fish, sea cucumbers, *Trochus* and shark fin which are sold to Nako Fisheries, in the Market, Asia Pacific Ltd, Kai bars and hotels (in order of frequency).

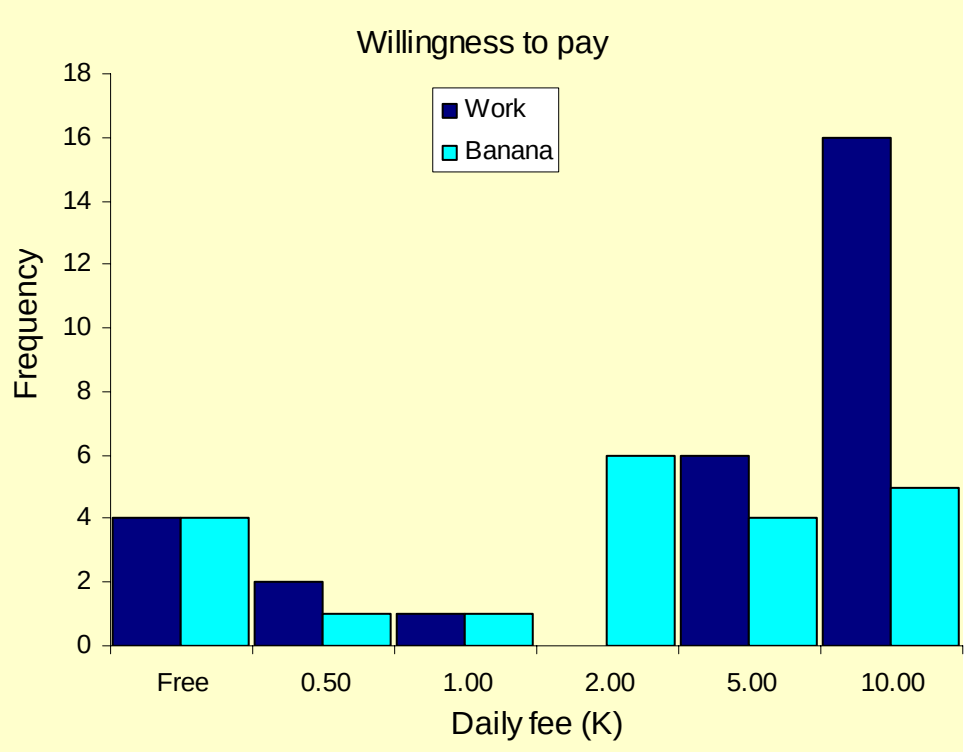
The owners / operators of banana boats have a different profile. As a group, they come to Alotau for a much wider range of reasons and for varying frequencies and durations. The frequency of visits is usually between 6 days per week and once a week. They primarily come to carry passengers, and sell fish and shark fins, but also bring a wide range of fresh, dry and smoked seafood products in addition to other market goods. In contrast to the workboat group, the operators of banana boats sell most of their seafoods in the market (15 responents), at Nako Fisheries (8), to Asia Pacific Ltd (2), at Kiwali[5] (1) or on the roadside (1). The usual number of passengers they carry is between 8 and 15, but ranges between 4-19. Most banana boat operators stay for 1 or 2 days, with very few staying longer (3 days). Whilst in Alotau, this group tends to stay in Sanderson Harbour, but a few find lodging in Alotau, at the market jetty or stay with friends or Wantoks.

All of the people interviewed were shown a drawing of the proposed project location and design. 100% responded that the proposed small boat basin and wharf facilities were a good idea for the following reasons: (i) it was closer, with easy access to the market and business centre; (ii) loading and unloading of passengers and freight would be easier; (iii) it would allow them to avoid the overcrowding in Sanderson Harbour; and (iv) the new harbour would improve safety of the boat by providing shielding from rough conditions and providing a better opportunity for people to keep an eye on their boat from shore. When asked if they would use the proposed facility, 46 people (of 47 who answered this question) asserted that they would use the new facilities if they were built. Only one was not sure stating that the Nako Fisheries wharf was available. Most people responded that they would use the facility overnight, with only 1 saying not, and 2 who were not sure (1 concerned about whether it would be calm enough).

Both groups of boat owners / operators were generally willing to pay for the use of the proposed facilities. Only a total of 8 of the respondents thought that the facilities should be free. The main reasons given for why people would be willing to pay for using the new small boat basin and wharf facilities were (i) if they were free they would be misused; and (ii) there was an acknowledgement that they were there to make money, therefore it was fair that a fee should be charged.

[5] Kiwali and Asia Pacific Ltd is a locally based exporter of sea cucumbers, trochus, sharfin and other dried products

Figure 8: Willingness to pay for the use of the proposed small boat basin and wharf facilities near the Main Market, Alotau.
Data are the frequency of responses on the question of what people would be willing to pay per 24hours for use of the proposed new facilities. Data are separated for operators of workboats and banana boats. Where people responded with a range of values (e.g. K5-K10) only the lowest value was used.




## 4. Potential Environmental and Social Impacts and Mitigation Measures

Annexes 1 and 2 use an ADB screening checklist to provide details on the potential environmental and social impacts of the proposed development near the Alotau Main Market. The main points are summarized below.

### 4.1 Environmental / Social Problems Due to Project Location

There are no significant negative environmental or social impacts expected with construction of a protected small boat basin and wharf facilities near the main Market at Alotau. The main reasons for this conclusion are: (i) the project design has already taken into consideration issues of water quality, minimised disruptions to small areas of reef and ensures that disruption of the wave climate and shoreline processes is minimised; and (ii) the area has already been damaged through past clearing on land, construction of a shoreline road and jetty and use of the area by boats. In general the site is in relatively good condition, and provided good practices are established for rubbish disposal and during construction, should remain in good condition. No human uses of the site will be permanently displaced (no relocation of residential communities is required; none are located on the government land between the shoreline and the Abel highway). The facilities that are proposed are intended for the benefit of the current users of the main market, and business and administration centres, while reducing their reliance on the congested facilities in Sanderson Harbour. Benefits are focused on all members of the community, with a

focus on small boat operators, often not specifically catered for. The project is consistent with the intent of the 1992 foreshore development plan.

## 4.2 Environmental / Social Problems Related to Design

The project has been designed to minimise negative interactions with physical and biological features in the project area. The main principle that was adopted was pile construction of the timber jetty approaches (to ensure good water circulation near the shore) and a breakwater placed 25m offshore able to provide protection without heavily impacting shoreline processes of wave attenuation and without creating a wave-reflective surface (as most wharf faces do). The overall structure is not expected to cause adjacent scour and sedimentation problems.

It is expected that a small area of coral reef (30m x 10m) will be affected by the development. The seagrass areas in a band about 20m wide can also be expected to be lost during operation of the facility. A coral reef area adjacent to the western breakwater has been specifically avoided in the design to reduce overall damage. The loss of the corals in the eastern side of the development (Figure 4) will be addressed by physically relocating the corals outside of the development footprint. Where this type of relocation has been attempted in the past, survival rates of the corals has been in excess of 80%.

Access to the site will take advantage of existing roads. The project has a very small footprint, so there is minimal interaction with any environmental features or areas of significant human activity. In terms of social benefits that might be accommodated in project design, these really are the main point of the project. The proposed small boat basin and jetty facility is designed specifically to provide benefits to the existing users of the Alotau market, business and administrative areas (with a focus on small boat operators and marketers), improving their access and alleviating some of the congestion in Sanderson Harbour.

## 4.3 Environmental / Social Problems Associated with the Construction Stage

All environmental impacts associated with the construction phase of the project are deemed to be insignificant, mostly because of the small scale of the project. The contractor will be specifically instructed to avoid damaging the coral reef areas outside the footprint of the development and to relocate an area of corals inside it. Although there will be some loss of seagrasses in the area, the total area is small in relation to the available habitat in the vicinity of the development.

The main physical effects of construction activities will be limited disturbance of marine sediments during driving of piles, during construction of the breakwater, and relocation of some coral reef. This temporary disturbance of sediments is not expected to have much effect in the area because flushing and water clarity are excellent, and fine sediments likely to lead to excessive turbidity generally are not present in the area (most is sand with very little mud).

Land-based construction activities will be quite limited. No land clearing is required because the site is flat, compacted, and only covered with grass. The few tress present will not be disturbed. The presence of construction workers could increase the human waste inputs to the area; construction site toilet facilities are recommended. Most of the construction workers will be drawn from Alotau, which will reduce the volume of waste that might normally be associated with a construction crew that resides at the construction site. Construction at the site will create some

employment opportunities, but not a substantial amount. This is a small benefit to the Alotau area.

Boat access to the market beach will be restricted somewhat during construction of the small boat basin and jetty. This is inevitable and will cause some temporary focus of activities on other parts of the beach or in Sanderson Harbour.

### 4.4 Environmental / Social Problems Resulting from Project Operations

Few environmental and social problems are anticipated with the operation of the small boat basin and jetty, but this requires implementation of the proposed mitigation measures (see Table 2). Environmental problems are not anticipated if proper maintenance of the facilities is in place and there is a waste management strategy implemented by a Harbour Management Unit (this function could be shared between Alotau Municipality, NFA, and Harbours Board). Waste management should include relocation of the present market dump and regular collection and disposal of solid waste on shore, collection of solid waste from vessels tying up to the facilities, clearing debris from the shallow water areas around the facility, and strict enforcement of “no bilge pumping” and “no tank flushing” regulations within the basin.

The potential benefits of improved facilities near the main market could include increased revenues to the Government from collection of wharf fees. Vessels and small boat operators using the harbour should increase the efficiency of their activities while in port. The facility should improve the link between island marketers and the main market, the business and administration centres and other locations.

The project is not expected to have much impact on any existing problems with HIV/AIDS, or other STDs. Nevertheless, public awareness campaigns addressing the HIV problem should be implemented in this area, as in other ports and harbours in PNG.

## 5. Institutional Requirements, Required Studies, and Environmental Monitoring Program

The responsibility for future environmental management of the small boat basin and jetty facility near the Alotau Main market will lie with the project proponent, which would be the National Fisheries Authority, in association with Harbours Board. These entities represent the government interest in the facilities, and would have to ensure that the contractor who builds the facilities incorporates all the required mitigation measures that have been specified in this document and reviewed by way of this document by the Department of Environment & Conservation (DEC). We understand that this project constitutes a Level 1 Activity. It is envisaged that no further monitoring of the project will be required.

## 6. Findings and Recommendations

The proposed jetty, shore-based facilities, shore protection works, and harbour improvements in Sanderson Bay have undergone a fairly exhaustive environmental screening process, which involved a site visit, consultations with project stakeholders and beneficiaries, review of documentation, charts, and aerial photographs, and collaborative environmental design with the project engineer. It is believed that the process has been sufficient to determine all possible interactions between the project and the environmental and social conditions at the site. Several factors preclude any significant negative environmental and social impacts associated with the project. These are: the small scale of the project; absence of any significant sensitive coastal

and marine habitats in an area that is already a working harbour; the specific social and economic benefits designed into the project; and the specification of mitigation measures and construction best practices to minimize environmental interactions.

## 7. Conclusions

This EIA has determined that the proposed small boat basin and jetty facilities at the Alotau Main Market can be constructed and operated with no significant negative environmental and social impacts subject to the implementation of specified mitigation measures. Environmental and social benefits should result from proper operation of the facilities. This project can be classified as a Level 1 Activity (DEC) (relatively small scale).

## 8. References

Smith, I.E. & Davies, H.L. 1973. Samarai, Papua new Guinea Geological Series Explanatory Notes. Sheet SC/56-9 1:250,000 International Index, Department of Minerals & Energy, Bureau of Mineral resources, Geology & Geophysics.

NOAA. 1996. International Station Meteorological Climate Summary, Version 4.0. September 1996. National Climatic Data Centre, Asheville, NC.

## Annex 1. Checklist of Environmental and Social Parameters

1. The checklist shown in Annex 2 below has been modified slightly from the specified ADB guidelines, with a column for supplementary comments, rather than a list of supplemental information sources, to make the checklist more informative. In addition, details on the potential damage to the environment and social values, and possible protection measures, have been made specific to the Alotau site, rather than relying on generic details in the ADB guidelines for ports and harbours. This makes the rationale for determination of significant effects clearer. Note that the significance of impacts is determined on the assumption that recommended protection measures will be implemented and the impacts to be considered are therefore residual. Otherwise, the ADB-specified format for the checklist for ports and harbours has been retained.

2. The types of impacts considered result from construction and operation of a small boat basin and jetty adjacent to the main market in Alotau.

3. A major impact can be considered as follows: (for environmental resources) the project affects an entire population or species in sufficient magnitude to cause a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any other populations or species dependent upon it, to its former level within several generations; or (for social values), the project affects a subsistence or commercial resource use, business activity, or social behaviour to the degree that the well being of the user or local community is affected over the long term.

4. A moderate impact (less significant) can be considered as follows: (for environmental resources) the project affects a portion of a population or habitat and may bring about a change in abundance and/or distribution over one or more generations, but does not threaten the integrity of that population, or any population dependent upon it; or (for social values), a short-term effect upon the social and economic well being of resource users or local communities using the project area may also constitute a moderate impact, but from which recovery is expected within 3-6 months.

5. A minor impact can be considered as follows: (for environmental resources) the project affects a specific group of localized individuals (plants and animals) within a population or a habitat over a short time period (one generation or less), but does not ultimately affect other trophic levels or the population itself; or (for social values), activities of resource users or local communities in the project area are not affected measurably beyond a minor disturbance of resource use or local activities, from which recovery is relatively quick.

6. These definitions embody the concept of recovery from impact. Basically, a habitat or population that can recover fairly quickly from a project impact is not considered to be significantly impacted. Also, if the habitat or population affected is only a small percentage of the total population or habitat in the immediate area, then the impact can also be considered insignificant. With regard to socioeconomic parameters, if a project activity causes a negative impact in one parameter which can be compensated by an overall positive development impact, then the impact can usually be considered acceptable.

7. See the main report for an expanded discussion of the biophysical and social context of the Alotau market area and the rationale for determination of residual impacts.

## Annex 2. IEE Checklist (Ports & Harbours) for Alotau small boat basin and jetty facilities

| Actions Affecting Environmental Resources and Social Values (A) | Damage to Environment and Effect on Social Values (B) Residual Impacts | Recommended Feasible Protection Measures (C) | IEE – Negative Effects (D) | | | | Supplementary Comments (E) |
|---|---|---|---|---|---|---|---|
| | | | No significant effect (D1) | Significant Effect | | | |
| | | | | Small (D2) | Mode-rate (D3) | Major (D4) | |
| ***Actions Affecting Coastal Marine Habitats and Resources.*** | | | | | | | |
| 1. Location of facilities in fisheries reproduction zones.<br>2. Location of facilities in fisheries capture zones.<br>3. Sediment runoff and disposal of dredge spoils in fisheries reproduction zones.<br>4. Sediment runoff and disposal of dredge spoils onto coral reefs and seagrass beds.<br>5. Construction on coral reefs and seagrass beds.<br>6. Clearance of mangrove forest.<br>7. Oil spills and leakage within harbor which escape the harbor area.<br>8. Oil spills from vessels on way to and from harbor.<br>9. Introduction of | 1. Negligible loss of fisheries reproductive potential.<br>2. Minimal disruption of recreational fishing during construction.<br>3. Negligible loss of fisheries reproductive potential.<br>4. No impact on seagrass beds; no impact on coral reefs.<br>5. Some impact on the seagrass bed (loss of 840 sq m); Some loss of coral reef area (300 sq m).<br>6. No impact on mangroves.<br>7. Negligible impact on coastal habitats and resources.<br>8. Minimal impact on coastal habitats and resources.<br>9. Unlikely introduction of new invasive species, parasites, algae. | 1. No mitigation required.<br>2. The new jetty will provide increased access to recreational fishing areas.<br>3. Apply sediment controls (silt fences, directed drainage) during shore-based construction; raw materials with low silt and clay content should be used.<br>4. Apply sediment controls, as noted above.<br>5. Corals within the project footprint should be manually relocated immediately outside the project area.<br>6. No mitigation required.<br>7. The project is not directly involved with fuel storage or handling; nevertheless, measures can be suggested, as follows: strict fuel transfer rules (daytime); contingency plan with adequate fuel spill handling equipment.<br>8. Only very small vessels (<15 m long) use the site – fuel volumes are small; apply a contingency plan with adequate fuel spill handling equipment.<br>9. Cruise ships expected in Milne Bay to pump ballast tanks outside PNG territorial waters. | ✓<br>✓<br>✓<br>✓<br>✓<br>✓<br>✓<br>✓<br>✓ | | | | 1. Project is unlikely to affect fish spawning.<br>2. People fish off the existing jetty; There is no commercial fishing in the area.<br>3. No dredging to be undertaken; This is not a fisheries reproduction zone.<br>4. There is a seagrass bed and coral reef within the footprint of the project. It is expected that the seagrass area will be lost. The coral reef will be relocated and it is expected that up to 80% of corals can be retained.<br>5. Coral loss needs to be mitigated through relocation of as many colonies as possible to nearby areas.<br>6. There are no mangroves in the area.<br>7. The area is well-flushed, with proper handling, impacts are likely to be minimal.<br>8. The project is not attracting new vessels *per se*, but is instead providing services to existing vessels; better facilities and harbor zoning should reduce the risk of collisions and spills.<br>9. Cruise ships have been calling in to Milne Bay since 1998, so ballast water contamination of the area may already have occurred. |

| Actions Affecting Environmental Resources and Social Values (A) | Damage to Environment and Effect on Social Values (B) Residual Impacts | Recommended Feasible Protection Measures (C) | IEE – Negative Effects (D) | | | | Supplementary Comments (E) |
|---|---|---|---|---|---|---|---|
| | | | No significant effect (D1) | Significant Effect | | | |
| | | | | Small (D2) | Mode-rate (D3) | Major (D4) | |
| ballast water. | | | | | | | |
| ***Actions Affecting Recreational, Resort, Beach Areas in Coastal Zone*** | | | | | | | |
| 1. Location of facilities too close to recreational areas.<br>2. Escape of liquid and solid wastes from harbor area, especially floatables.<br>3. Air pollutant emissions from harbor facilities and ships.<br>4. Disposal of dredge spoils along shoreline.<br>5. Oil spills and leakage within harbor which escape harbor area.<br>6. Oil spills from vessels on way to and from harbor. | 1. There will be temporary displacement of recreational use of the shore during construction.<br>2. Negligible incremental impact due to the new basin and jetty.<br>3. Negligible incremental impact due to the new basin and jetty.<br>4. No impact on recreational areas.<br>5. Minimal impact on recreational areas.<br>6. Minimal impact on recreational areas. | 1. Site management will improve the environmental quality of the remaining area; trees will be maintained; the area around the new facility will be greened.<br>2. Solid and vessel waste management facilities could be provided at the site; toilets are needed in the area.<br>3. The project will not increase the number of vessels, but may attract some that currently use Sanderson Harbour.<br>4. No dredging will be undertaken.<br>5. Only very small vessels (<15 m long) use the area – fuel volumes are small; apply a contingency plan with adequate fuel spill handling equipment.<br>6. Contingency plan with adequate fuel spill handling equipment. | ✓<br>✓<br>✓<br>✓<br>✓<br>✓ | | | | 1. Only an access road will be required to the shore area at the site to provide access to the new basin and jetty.<br>2. The area is not significantly presently polluted; waste management plans should be developed and implemented as part of the development of shore facilities to ensure no declines in environmental quality.<br>3. Air quality is good.<br>4. No dredging will be undertaken.<br>5. Small vessels already use the site; good practices for handling and disposal of oils are needed.<br>6. The project is not likely to affect the movements of larger vessels which use the overseas wharf just east of Sanderson Bay. |
| ***Actions Causing Unacceptable Sanitation Conditions in Harbor Area*** | | | | | | | |
| 1. Inadequate provision of water supply to port facilities and ships.<br>2. Inadequate management of waste emissions from port facilities: a. liquid sanitary and industrial | 1. No impact of the project on water supply.<br>2. No impact due to the new basin & jetty.<br>3. Small negative impact on water quality.<br>4. Minimal impact expected as long as oil and fuel are | 1. Water supply not included as part of the project.<br>2. The project does not include port facilities – just a jetty.<br>3. Solid and vessel waste management facilities could be provided; no bilge cleaning in the small boat basin or jetty area.<br>4. Contingency plan with adequate fuel spill handling equipment. | ✓<br>✓<br>✓<br>✓ | | | | 1. The new facilities are not expected to cause a significant increased demand for water in Alotau.<br>2. -<br>3. The area already has some pollution problems; waste management is required.<br>4. Compliance with rules for oil and fuel handling is needed. |

| Actions Affecting Environmental Resources and Social Values (A) | Damage to Environment and Effect on Social Values (B) Residual Impacts | Recommended Feasible Protection Measures (C) | IEE – Negative Effects (D) | | | | Supplementary Comments (E) |
|---|---|---|---|---|---|---|---|
| | | | No significant effect (D1) | Significant Effect | | | |
| | | | | Small (D2) | Mode-rate (D3) | Major (D4) | |
| wastes; b. solid sanitary and industrial wastes; c. gaseous emissions from shore facilities.<br>3. Inadequate management of wastes from ships, including bilge water, sanitary waste, and garbage.<br>4. Escape of oil within harbor. | handled correctly; area is resilient due to good circulation. | | | | | | |
| ***Handling of Hazardous Materials Within Harbor*** | | | | | | | |
| 1. Dust emissions.<br>2. Hazardous material (inflammables, explosives, toxic substances). | 1. No dust associated with small boat operations.<br>2. The project is not dealing with hazardous materials. | 1. No mitigation required.<br>2. No specific mitigation required. | ✓<br>✓ | | | | 1. –<br>2. Fuel storage and handling are not elements of the project. |
| ***Handling of Materials to and from Harbor*** | | | | | | | |
| 1. Traffic congestion.<br>2. Hazardous material spills (inflammables, explosives, toxic substances). | 1. Slight increase in traffic on the access road.<br>2. With the exception of petrol cans, the small boat and fisheries activities supported by the jetty will not involve hazardous materials. | 1. The access road to the jetty can be designed to maintain traffic flow.<br>2. Standard safe handling procedures for any materials moved across the new jetty. | ✓<br>✓ | | | | 1. At the moment, there is very little vehicle use of the access track.<br>2. Risks associated with hazardous materials can be minimized with safe handling of materials in proper containers. |
| ***Actions Affecting Local Socioeconomic Parameters*** | | | | | | | |
| 1. Inadequate housing and services for increasing | 1. Population will be transitory; facilities to be provided as part of overall area | 1. Overall development plan to provide water, toilet facilities, lighting; improved security.<br>2. No specific mitigation required, but | ✓ | | | | 1. Currently, islanders spend up to 2-3 days at temporary lodging near Nako Fisheries, where facilities and security are poor. |

| Actions Affecting Environmental Resources and Social Values (A) | Damage to Environment and Effect on Social Values (B) Residual Impacts | Recommended Feasible Protection Measures (C) | IEE – Negative Effects (D) | | | | Supplementary Comments (E) |
|---|---|---|---|---|---|---|---|
| | | | No significant effect (D1) | Significant Effect | | | |
| | | | | Small (D2) | Mode-rate (D3) | Major (D4) | |
| population.<br>2. Inadequate health precautions during construction: a. communicable disease hazards from imported workers/carriers; b. inadequate water supply and sanitation for workers.<br>3. Changes in land use patterns: a. displacement of agriculture; b. displacement of villages.<br>4. Immigration of workers and ship crews with different sociocultural values.<br>5. Excessive noise from harbor operations. | development plan.<br>2. No direct impact – local construction workers will be used; only a small number required.<br>3. No displacement of population or agricultural activities.<br>4. Negligible effect.<br>5. Negligible increase in noise. | HIV/AIDS awareness-raising should be undertaken.<br>3. No mitigation required; the project will have a very small footprint.<br>4. The project facilities will cater to the current users of the area and Sanderson Harbour nearby.<br>5. Standard noise controls could be implemented in the project area. | ✓<br>✓<br>✓<br>✓ | | | | 2. This is an open area, where the presence of a small construction crew will not have much impact.<br>3. The project will actually provide better facilities in the area and reduce overall problems in Sanderson Bay, this will create efficiencies for people using this area.<br>4. It is not expected that the basin & jetty will attract new users from outside Milne Bay.<br>5. Sanderson Bay is already affected by a small level of noise from harbor operations. |
| ***Actions Affecting Terrestrial Habitats and Resources*** | | | | | | | |
| 1. Clearing of forest and filling.<br>2. Establishing borrow area and quarry operation.<br>3. Disturbance of wildlife and loss of habitat. | 1. No impact; there is only grass at the site.<br>2. No impact.<br>3. No impact; there is no significant wildlife habitat in the area. | 1. No mitigation required; the shoreline area should be planted at the end of the project to improve shoreline stability and environmental utility.<br>2. No mitigation required.<br>3. No mitigation required. | ✓<br>✓<br>✓ | | | | 1. Replanting recommended at the end of the project to stabilize shoreline.<br>2. -<br>3. - |
| ***Changes in Coastal Hydrology*** | | | | | | | |
| 1. Deposition along | 1. No effects expected. | 1-2. Structures that are transparent to | ✓ | | | | 1-2. The area is exposed to low-moderate |

| Actions Affecting Environmental Resources and Social Values (A) | Damage to Environment and Effect on Social Values (B) Residual Impacts | Recommended Feasible Protection Measures (C) | IEE – Negative Effects (D) | | | | Supplementary Comments (E) |
|---|---|---|---|---|---|---|---|
| | | | No significant effect (D1) | Significant Effect | | | |
| | | | | Small (D2) | Mode-rate (D3) | Major (D4) | |
| adjacent coastal areas.<br>2. Erosion along adjacent coastal areas. | 2. No effects expected. | water flow are proposed near the shoreline where impacts are usually greatest; impacts of the breakwater are expected to be minimal. | | | | | swells and needs protecting for small boat users. SW swells are the most significant; The area has little longshore current and sediment movements – no significant problems are expected. |
| ***Actions Affecting Precious Historical, Cultural, Religious Monuments and Sites*** | | | | | | | |
| 1. Displacement or submergence of sites.<br>2. Alterations in coastal zone hydrology and shoreline.<br>3. Construction of infrastructure. | 1-2-3. No impact, as there are no areas of historical, cultural, or religious significance at the site. | 1-2-3. No mitigation required. | ✓ | | | | 1-2-3. - |
| ***Hazards from Access Roads/Traffic Leaving Harbor*** | | | | | | | |
| | Very slight increase in vehicle traffic to the site. | No mitigation required. | ✓ | | | | - |
| ***Navigation Hazards from Ships Entering or Leaving Harbor.*** | | | | | | | |
| | Only small vessels (<6m) will enter the basin. | The jetty facilities will be unconstricted; only small banana boats will enter the basin area. | ✓ | | | | The proposed basin and jetty are expected to improve safety at the site and extend the time during which the area can be used. |
| ***Conclusions*** | | | | | | | |
| ✓ | No significant adverse environmental and social effects caused by the project. No further investigations needed. | | | | | | |
| | Significant environmental and social impacts as shown in Columns D2-D4. Follow-up EIA needed. | | | | | | |