



NATIONAL FISHERIES AUTHORITY

Environmental Impact Assessment
(Level 1 Activity)

**Construction of
fisheries and fuel facilities at Daru**

prepared by the

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



Site of the proposed jetty at Daru

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1. INTRODUCTION

An Environmental Impact Assessment (EIA) has been undertaken for the proposed construction of a fishing jetty and fuel facilities at Daru, Western Province. Construction of the jetty is a component of the Fisheries Management and Development Project, 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 the Fisheries Management and Development Project is to contribute to the reduction of poverty in rural areas through increasing, or preventing a further decline in, 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 a finger jetty for small local boats to be constructed in the main harbour area at Daru, in Western Province. The facility will cater for up to 20 small boats (banana boats) and provide access for foot traffic, wheelbarrows and hand carts. It is expected that BP will provide fuel facilities on the jetty at a later stage to further enhance this project, and will be responsible for all environmental requirements in connection with that development.

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** within 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 Daru area and Papua New Guinea as a whole.

This EIA is based largely on work undertaken at the project site in August-September 2001 by John Carter, who, at the time, was working on behalf of Gillett, Preston & Associates Inc, a consulting firm engaged by the Asian Development Bank to prepare the design of the present project. The Initial Environmental Examination (IEE) was completed by Mr Carter in September, 2001 and involved field observations and consultations with intended project beneficiaries, to ensure collection of relevant primary data. The IEE process also included review of previous documentation for the location and interpretation of charts and aerial photographs of the prospective sites.

A key feature of the IEE 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. Dr Ursula Kaly, the Coastal Fisheries Management and Development Project's Environmental Monitoring Adviser has reviewed the original IEE and contributed to the preparation of this EIA. NFA understands that the original study was undertaken in accordance with the Asian Development Bank's Guidelines for Environmental

Assessments and for Selected Infrastructure Projects (Ports & Harbours) (ADB, 1993, 1998). While the Authority is not in a position to certify Mr Carter's findings it has no reason to doubt their veracity and value.

Daru is a small island located west of the mouth of the Fly River in Western Province, at northern end of the Torres Strait (see aerial photograph shown in figure 1 below). Daru is the administrative centre for the province, with air and sea links to other parts of Western Province and Port Moresby, and to Thursday Island in Australia.

Figure 1: Aerial photograph of Daru Island



There is one main wharf in Daru which extends about 500 metres into the strait between the island and the mainland at the mouth of the Oriomo River. This wharf comprises a causeway access (with bulk diesel storage tanks and various government buildings), a barge ramp, a small boat slip, a defunct marine rail-slip, and concrete wharves at the end of a piled wharf extension. All are in poor condition. The project is concerned with improving small boat access to the beach, across a wide muddy intertidal flat, and providing bulk fuel storage. These will improve services for the many small boat operators and marketers who need to access Daru, and reduce the high cost of fuel, which is a major impediment to business activities there.

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The project involves construction of a 300-metre long timber wharf (on piles) across the intertidal mud flat from the proposed market location in front of Maru Marine (about 200 meters west of the existing causeway) out to about one metre water depth at low tide. At the moment dinghies, sailing canoes and village boats beach wherever they can. At low tide this means a long difficult walk across the mud flats, and the need to securely anchor the boats to hold them against a rising tide. At high tide, this means boats are stranded while people are tied up with their business in

Daru and the tide drops. They have to wait for the next high tide before they are able to leave Daru. Either way, there is a loss of time and great inconvenience in the current arrangements. Some dinghies use the barge ramp at the end of the causeway but this requires walking over 0.5 km to the market with whatever goods are to be sold. The timber wharf would at least provide safe access to the beach and market (to be constructed before the end of 2001 by the province) over the shortest distance possible during low tide and allow secure tie-up during all stages of the tide.

The project also involves the construction of underground bulk fuel storage tanks on the waterfront in Daru, to address the high cost of fuel, which is due in part to the present shipment of petrol ("Zoom") in drums.

3. Description of the Environment

3.1 Physical resources

Daru is a small (4 x 5 km) low elevation island located only 3 kilometres off the mainland of PNG, opposite the mouth of the Oriomo River, about 10 km west of the mouth of the Fly River. Immediately to the south of Daru is Bobo Island, which is twice the size of Daru, but as a muddy mangrove cay is virtually uninhabited. Daru Island is partly composed of basalt lava and soft, easily weathered, calcareous tuff (containing Pleistocene coral fragments). Daru is the first of a series of four lava extrusions which run in a southeast line to the Murray Islands in Australia. Daru is also characterized by more recent alluvial sediments which make up the swampy fringes of the island in low-lying areas.

Most of the shoreline of Daru is very low elevation and composed of alluvial sediments (sand and mud) from the Oriomo River and weathered tuff. On the north side of Daru, where most of the town is located, there is an extensive shoal made up of tuff east of the causeway, and an extensive sand and mud flat west of the causeway that is about 300 meters wide. Mud flats extend around most of Daru, and are most substantial in the narrow channel between Daru and Bobo Island. The causeway and wharf at the northern side of Daru appear to have interfered with longshore sediment drift in this area, with apparent accumulation of Oriomo River sediments on the west side of the causeway. Mangroves are now starting to populate the area immediately adjacent to the causeway.

The physical setting of Daru is very much defined by the river influences of the mainland and the oceanographic conditions. There is a significant sediment supply from both the Oriomo River and the Fly River, which is distributed and reworked on the shore of Daru by very strong tidal currents and by the easterly waves which predominate during the period May-November. Aerial photographs indicate very turbid conditions between Daru and the mainland, with distinct bands of suspended sediments driven by the tides. Tidal range in this area is normally between 2 and 2.5 metres, with a spring tide range of about 2.8 metres. The narrow strait between Daru and the mainland is quite shallow. Maximum water depth is only 5 meters in a very narrow channel (about 500 meters wide) known as the Daru Roads.

Freshwater on Daru is limited. Annual rainfall is only 2000 mm. In the past freshwater was extracted from the shallow aquifer or collected in rainwater tanks. Water is now piped across the channel from the Oriomo River and treated at a plant near the airport. There are no creeks on the island, given the minimal catchment; freshwater discharge is likely in the form of local culvert drainage during heavy rains.

3.2 Ecological resources

The specific project site is the foreshore between the causeway-wharf and the fish export businesses 300 meters to the west. This area has been heavily used as a market and squatter settlement. Vegetation is therefore limited to some beach grass, most of which has been trampled. Apart from one tree near the causeway, there are no trees on the project site. This area has no value as wildlife habitat. There is extensive mangrove forest on the southern side of Daru Island and on Bobo Island, far removed from the project site. The few seedlings and small mangrove trees that have established near the causeway are about 100-150 meters from the proposed wharf area and are not likely to be affected by the project.

There are no coral reefs on the north side of Daru Island, because of the extreme turbidity caused by river sediments and the strong tidal currents. For the same reasons, it is unlikely that there are extensive seagrass beds between Daru and the mainland. Fifteen to twenty kilometres to the south of Daru and Bobo Island are extensive coral reefs and seagrass beds, on Auwamaza Reef and the Warrior Reefs. Sea turtles, reef fish, lobsters, and beche-de-mer are commonly found in those areas, but not close to Daru Island. Barramundi are caught in the coastal waters along the mainland from the mouth of the Fly River to Saibai Island. The area immediately to the north of Daru is not considered prime fish habitat. Recreational and possibly subsistence fishing off the wharf at the end of the causeway is common. Fish are also caught near the low water mark and women harvest clams from the intertidal mudflats, usually east of the causeway. The mangrove forest on Bobo Island is a habitat for mangrove snails and crabs, which are sold in the market. The wharf site is quite remote from all the identified fish and shellfish habitat in the vicinity of Daru.

3.3 Human and economic development

Daru is an important commercial and administrative centre for the Western Province, with a population of 12,879 in 2000. It is located in a productive coastal and marine area which has encouraged the development of export-based fisheries (lobster, beche-de-mer and barramundi among others). Apart from administration of Western Province, fishing and exporting appear to be the main business activities in Daru (there is frequent reference to illicit trading, given Daru's location close to the Australian and Indonesian borders). The main business routes are between Daru, Port Moresby, Thursday Island, and Cairns.

Despite the relatively active fish export business in Daru and a fairly high domestic factor income compared to other provinces, many of the public facilities in Daru are in a decrepit condition (for example, the causeway which is at least 28 years old, the marine rail-slip, the BP diesel storage tanks etc. The wharf is an exception and was recently upgraded). Part of this may be due to the system of "agents" which prevails in Daru. For example, Daru Trading is the agent for Harbours Board and BP, while at the same time having a primary interest in fisheries exporting and selling provisions in Daru, among other things, which probably attracts more of their attention and investment. This situation, and the lack of some key government staff and primary business representatives in Daru, may lead to some essential maintenance of facilities being neglected.

The immediate foreshore in Daru is occupied by the causeway, the current temporary market (which is located on Mobil's property), the area of the new market facilities (to be constructed on the old market lot), and two of the fish export businesses, shops, and the old BP station on the landward side of the road. The Daru foreshore and

beach area are extremely busy, with the squatter settlement (40 huts, mostly mainland people from up the Fly River) located immediately seaward of the current market, several hundred people in the market, and an estimated 200-300 more milling about on the shore waiting for tide changes. At the time of the survey there were approximately 30 dinghies and 15 sailing canoes on the flats (apparently there are 200 dinghies involved fulltime in fishing). The diesel boats used in the lobster fishery moor in the deeper water off the mudflats. There is a constant stream of people coming from villages across the channel (Dorogon and New Katatai) and other points up the Fly River, landing on the flats or pulling up at the end of the causeway and walking with their goods to the market. Many of them try to return to their villages (if they are close enough) at the end of the day, but this requires that they sell all their goods, which seems to rarely happen.

Products sold in the market include barramundi, mullets, rabbitfish, triggerfish, snappers, garfish, skates, small sharks, catfish, octopus, turtle, dugong, mangrove crabs, snails, clams, deer, some betel nut, coconuts, bananas, derris root, some vegetables, yams, sago, mangrove wood, stones, petrol, kerosene, bags, and mats. Compared to other markets observed in PNG, there is a very high incidence of fresh protein. At the moment, there is only a very basic temporary shelter provided for the market. There is no water available and there are no toilet facilities. The province is planning to rebuild the market, including a fish market and a separate stall area for meat, vegetables, and other goods, with water and toilet facilities provided. This will address the ongoing problem of poor market facilities in Daru. The plan also calls for relocation of the squatter settlement and building a seawall in front of the market.

There is a serious concern with the availability and price of fuel in Daru. Because Daru is basically at the end of the line and cannot receive petrol in bulk supply, there is a very high cost to shipping petrol in drums. There is a high demand for petrol for the 200-300 dinghies with outboard motors and the vehicles in Daru. Diesel is brought in bulk to Daru and stored in the BP tanks on the causeway. Most of this diesel is reserved for the Elcom generator. The Mobil agent also sells about 4,000 litres of diesel per month. Theft is a big problem at the BP site; the security fence is broken and more than 2,000 litres of diesel are stolen per week (August, 2001). There is a correlated decrease in diesel sales at the Mobil agency near the airport. Petrol is sold in 20-liter containers by individual hawkers at the market, mostly to individuals who cannot go to the Mobil agent to buy directly.

Another problem in Daru is the delivery of fuel. The fuel boats do not always arrive on schedule, which sometimes causes a shortage of fuel. Local business representatives believe that if there were a more reliable supply of petrol (and reduced prices), there would be more fishing effort, which would increase exports of fish and other seafood. Future demand for fuel in Daru might increase with the PNG patrol boats basing some of their operations in Western Province and with the ferry which has recently started operation between Daru and Thursday Island. There is also reference to up to eight prawn trawlers shifting their operational base from Port Moresby to Daru.

3.4 Social issues

Consultations were held with people selling goods in the make-shift market and others who were accessing the beach and market via the causeway. The social issues for the people who use the beach and foreshore of Daru can be classified into three basic categories: those affecting the squatter village; those pertaining to the people who use the market; and the general problems of access to the shore, which pertain to most people in the area.

The main problem in the squatter village is that there are no facilities at all (no water and no toilets). The huts are extremely flimsy and very crowded together. Conditions in the settlement are very unhygienic. Most of the people in the settlement are from the Fly River area. The real problem is that they will have to move at some point in the near future, and it is not clear where they can go or how they will provide houses and basic services for themselves. Other disadvantaged groups in Daru have been forced to settle at Perfume Point, which is the dump. The project cannot directly address this problem.

Many of the people selling goods at the market had complaints about the current set-up (the previous market was torn down to make way for a new market, but the contractor responsible for the project absconded with the funds, leaving no market at all, old or new). Some did recognize that the province is trying to get the new market built. Nevertheless, consultations brought a litany of complaints, including the low price paid for fish by the commercial operators. Most people preferred to try selling their fish in the market or, failing that, selling their fish on the streets at the end of the day. Several said that they would like access to overnight cold lockers, so that they would not have to sell all their catch in one day, or take fish home at the end of the day. However, this would require some elaborate security system to work for individual sellers. Most sellers did not use ice to preserve their fish, yet ice can be bought from Daru Trading. The sellers appear to try to minimize their inputs, and take a chance selling their catch as quickly as possible before the fish spoil. Most sold their fish whole (by the piece) as there are no scales for weighing and selling fish by the kilogram. Many complained about the current situation where they have to sit on the dirt in the sun and try to keep their fish or produce clean. There is no easy access to water and no toilets are available. All complained about the price of fuel for their boats. The plans for the new market were reviewed with the Provincial Works Coordinator in Daru – they appear to address most current concerns about the market, except that overnight storage will not be provided. As in other locations, fees will be charged for use of the market. The new market, of course, will not solve the overarching problems of the price of fuel and the low price paid for fish by the commercial buyers.

A problem for many people is accessing the shore at Daru. Almost all those consulted complained about the long, slippery walk across the mudflats at low tide, especially difficult when they are carrying fish or other goods. Fish and other items that should be kept as clean as possible get dragged in the mud in an area that is receiving waste from hundreds of people. At low tide, to avoid the muddy trek, many have been forced to use the barge ramp at the end of the causeway and then walk about 0.5 km to the market. Waiting for a favourable tide for landing or launching their boats was considered inevitable, but a time-waster.

Lack of law and order in Daru is a concern. There have been frequent lootings and trashings of businesses and buildings in the last two years. Most shops have extreme security measures which still do not appear to be effective, and the police have not been able to prevent some recent incidents. Most of the crime in Daru appears to be property-related. Incidence of murder and rape is lower in Western Province than in other provinces in PNG.

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 interventions in Daru. 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 timber wharf on piles and a bulk fuel storage facility which are a function of their location on the beach and foreshore of Daru. There is no other place to put these facilities in any case. There are no sensitive coastal or marine habitats which can be affected by the project. No human uses of the site will be permanently displaced. No relocation of residential communities is required; relocation of the squatter settlement is a prerequisite of the market project, not a requirement of the wharf project. The timber wharf is expected to link up with the market, providing access on the west side of the new facilities. The use of a wharf to the west of the present causeway will reduce some of the occasional congestion at the barge ramp at the end of the causeway. Social benefits are therefore expected in an area that is used by up to 500 people.

The bulk fuel storage facility will be constructed on Mobil's property, which Mobil is interested in leasing or selling. No conflicts are expected with location of fuel storage in that area. A bulk fuel storage facility in Daru will provide cost benefits and efficiencies for all potential petrol and diesel users, especially the fishing dinghies, prawn trawlers and patrol vessels operating in the western region.

4.2 Environmental / Social Problems Related to Design

The project has a very simple design and small footprint. Given this and the absence of any sensitive coastal and terrestrial habitats at the project site, no environmental and social problems associated with the design of the wharf and the bulk fuel storage facility are anticipated. Pile construction of the timber wharf will ensure good water circulation under the structure. Adjacent scour and sedimentation problems are therefore not expected. The wharf will be linked to the west side of the market, to minimize any congestion areas in the market itself. The bulk fuel tanks will be located underground, which reduces the footprint of this facility. The only visible features of this facility will be a secured fuel dispensing area. The fuel feeder line (2 pipes) will run from the existing wharf to the storage facility, and will be fully secured and buried where possible. The design therefore reduces opportunities for theft and minimizes any safety hazards associated with transfer and storage of petrol and diesel.

The project is intended to bring social and economic benefits to Daru, specifically those involved in coastal fisheries and transport. The wharf is designed to give dinghy access to the shore during all stages of the tide and provide a secure place to tie up boats. This will allow safe movement of market goods and eliminate the possibility of contamination of products with mud on the intertidal flats. These features are expected to save time and improve the quality of goods which can be sold in the new market. The provision of bulk fuel storage should reduce the possibility of fuel shortages, reduce the price of fuel in Daru, and eliminate the current unsafe practice of many individual fuel sales and transfers which have an explosion hazard. The individual fuel hawkers, however, may have reduced demand for their services, although they may still have some involvement through provision of fuel credit to small boat operators.

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 and the absence of any sensitive coastal and terrestrial habitats at the project site. The main physical effects of construction activities will be limited disturbance of marine

sediments during driving of piles. This temporary disturbance of sediments is not expected to have any measurable effect in an area that is already very turbid due to strong tidal currents and the outflow of the Oriomo River.

Land-based construction activities will be quite limited, including only the installation of the fuel feeder line and construction and burial of tanks in an area that has no habitat value. Construction should include sediment controls, such as a silt fence, to reduce the amount of sediment that enters the water (but this area is very turbid in any case, so this is not a large concern). The small workforce required during construction will not have any measurable impact on waste inputs to the area. Construction at the site will create some employment opportunities, but not a substantial amount. This is a small benefit to the Daru area.

Construction activities should not cause any significant inconvenience to people using the beach and foreshore of Daru, since the project site only takes up a small percentage of the available space in this area.

4.4 Environmental / Social Problems Resulting from Project Operations

No significant environmental and social problems are anticipated with operation of the wharf and the bulk fuel storage facility, but this conclusion is based on implementation of the proposed mitigation measures (see Annex 2). Operation of the wharf should create no environmental issues. The boats that will use this wharf include small outboard motor dinghies and sailing canoes, which produce no operational wastes. Therefore, no specific waste management is required in this area. Because most of the facilities associated with the bulk fuel storage will be secured (underground tanks and secured pipelines) the most vulnerable areas, in terms of risk of spills, are at the transfer point at the end of the wharf, during pumping of fuel from the fuel carriers, and the dispensing area at the bulk fuel storage facility itself. The operation of the bulk fuel storage facility will therefore require fuel safety training for staff, and safety protocols during the transfer of bulk fuel and the sale of retail fuel (such as transfer of fuel only during daylight hours). The fuel dispensing area will have to be very firmly secured 24 hours per day. If there are no fuel spills, then there will be no environmental issues associated with operation of the facility. The strategy is therefore to reduce the risk of spills at the two transfer points. In the event of a spill, fuel transfer should cease immediately and fuel spill clean-up equipment should be accessible on the wharf (there is presently a container with fuel clean-up equipment, but its condition is unknown). It should be noted that containment of petrol and diesel, which are light hydrocarbons, in an area with strong tidal currents, is almost impossible. Most of the spilled fuel will be carried away in the tidal currents and will quickly evaporate. Smaller volume fuel transfers at the dispensing facility are less of a concern, and will be contained within a bunded yard. Further details on management of fuel spills are provided in Annex 2.

Operation of the wharf will require some collection of fees to allow cost recovery and ongoing maintenance. Although all people who were consulted confirmed that they would pay some nominal fee to use a facility which they see as a benefit, in practice collection of fees could be difficult. Wharf fees may have to be worked into the fee structure for the market, where collection of fees is more feasible than on a wharf.

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

The responsibility for future environmental management of the facilities in Daru 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. The proponent should work with the Office of Environment and Conservation in final design and implementation of the proposed environmental and social benefits monitoring program, which are defined below.

The main purpose of the environmental and social benefits monitoring is to monitor beach width, potential hydrocarbon contamination in water and sediments, and social benefits which may be associated with construction and operation of the small boat wharf and bulk fuel storage facility at Daru. The proposed approach is time-series monitoring, at regular intervals, of specific environmental and social variables which may be directly affected by construction and operation of the proposed facilities. Periodic physical measurements will be made of beach width adjacent to the wharf. Water and sediment samples will be collected and analysed for hydrocarbons. Socio-economic data will be collected from respondents who use the new facilities, to indicate the extent of social and economic benefits.

Required human resource inputs would be as follows:

- Environmental monitor: 25 days over two years (sampling, analysis, report preparation)
- Social scientist: 25 days over two years (surveys and report preparation)

Inputs would be scheduled at periodic occasions over the life of the project. Provision would be needed for four trips to Daru over two years by both the environmental monitor and the social scientist, to span the immediate pre-construction period, the construction phase, and the initial operational phase.

The monitoring program is also supported by an environmental monitoring advisor, included within the capacity-building component of the project. This is proposed in order to ensure compliance with proposed mitigation measures, and to work with a locally contracted company to implement the monitoring program.

6. Findings and Recommendations

The proposed timber wharf and bulk fuel storage facility in Daru have undergone a comprehensive 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 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 terrestrial habitats at the project site; the specific social and economic benefits designed into the project; and the specification of mitigation measures and construction best practices to minimize environmental interactions.

Environmental and social benefits monitoring has been proposed to ensure compliance with mitigation measures, and to measure the effects of the proposed project on specific environmental parameters and possible social benefits.

7. Conclusions

This EIA has determined that the proposed timber wharf and bulk fuel storage facility in Daru can be constructed and operated with no significant negative environmental and social impacts. Social benefits should result from proper operation of the facilities. This project can be classified as a Level 1 Activity and is relatively small scale. Subject to the implementation of specified mitigation measures and environmental and social benefits monitoring, the project should be able to proceed without any significant negative effects.

Annex 1. Checklist of Environmental and Social Parameters

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 Daru 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.

The project impactors that are considered result from construction and operation of a timber wharf on piles and a bulk fuel storage facility.

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.

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.

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.

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.

See the EIA report for an expanded discussion of the biophysical and social context of Daru and the rationale for determination of residual impacts.

Annex 2. IEE Checklist (Ports & Harbours) for Daru fisheries jetty and fuel facilities

Actions Affecting Environmental Resources and Social Values (A)	Damage to Environment and Effect on Social Values (B)	Recommended Feasible Protection Measures (C)	IEE – Negative Effects (D)			Supplementary Comments (E)	
			No significant effect (D1)	Significant Effect			
				Small (D2)	Moderate (D3)		Major (D4)
Actions Affecting Coastal Marine Habitats and Resources.							
<ol style="list-style-type: none"> 1. Location of facilities in fisheries reproduction zones. 2. Location of facilities in fisheries capture zones. 3. Sediment runoff and disposal of dredge spoils in fisheries reproduction zones. 4. Sediment runoff and disposal of dredge spoils onto coral reefs and seagrass beds. 5. Construction on coral reefs and seagrass beds. 6. Clearance of mangrove forest. 7. Oil spills and leakage within harbor which escape the harbor area. 	<ol style="list-style-type: none"> 1. No impact. 2. No impact. 3. No impact. 4. No impact on coral reefs or seagrass beds. 5. No impact on coral reefs or seagrass beds. 6. No impact on mangroves. 7. Negligible impact on coastal habitats and resources. 8. Minimal impact on coastal habitats and resources. 9. No concern. 	<ol style="list-style-type: none"> 1. No mitigation required. 2. No mitigation required. 3. No dredging planned. 4. No dredging planned. 5. No mitigation required. 6. No mitigation required. 7. The project will improve fuel storage and security in Daru, reducing theft and spillage which may contaminate water and sediments at the moment; specific measures can also be suggested, as follows: training in fuel handling; strict fuel transfer rules (daytime); contingency plan with adequate fuel spill handling equipment; underground bulk fuel storage on shore. 8. Bulk fuel transfer (instead of drums) may increase the chance of larger losses in the event of a vessel emergency; contingency plan with adequate fuel spill handling equipment will be required; high evaporative losses of petrol and/or diesel will mitigate environmental damage. 9. International vessels are not expected at Daru (too shallow). 	<ol style="list-style-type: none"> ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ 				<ol style="list-style-type: none"> 1. The project site is a polluted intertidal mudflat – not a fish spawning area. 2. No commercial fishing in this area; some women and children fish and collect clams at the low water mark. 3. - 4. There are no seagrass beds or coral reefs at the site, due to turbidity, muddy sediments, and high tidal velocities. 5. As noted above, there are no coral reefs or seagrass beds at the site. 6. There are no mangroves at the wharf site; some mangroves have started to colonize the area immediately to the west of the causeway, about 100 meters away from the wharf site. 7. There are no sensitive coastal habitats in the area of potential fuel spills (only a limited mangrove patch near the causeway); strong tidal currents would tend to disperse surface slicks of petrol or diesel; theft of diesel at the BP storage area on the causeway is possibly leading to diesel contamination of the causeway sediments, which may eventually leach to the intertidal mud flats. 8. Fuel transfers to Daru may increase in the future, which could increase the

Actions Affecting Environmental Resources and Social Values (A)	Damage to Environment and Effect on Social Values (B)	Recommended Feasible Protection Measures (C)	IEE – Negative Effects (D)			Supplementary Comments (E)
			No significant effect (D1)	Significant Effect		
				Small (D2)	Moderate (D3)	
8. Oil spills from vessels on way to and from harbor. 9. Introduction of ballast water.						risk of accidents and fuel losses; however, vessel traffic in Daru is very limited, so vessel collisions have a low probability. 9. -
Actions Affecting Recreational, Resort, Beach Areas in Coastal Zone						
1. Location of facilities too close to recreational areas. 2. Escape of liquid and solid wastes from harbor area, especially floatables. 3. Air pollutant emissions from harbor facilities and ships. 4. Disposal of dredge spoils along shoreline. 5. Oil spills and leakage within harbor which escape harbor area. 6. Oil spills from vessels on way to and from harbor.	1. No impact. 2. No impact. 3. No impact. 4. No impact. 5. No impact on recreational areas. 6. No impact on recreational areas.	1. No mitigation required. 2. The wharf is intended to facilitate use of the area by small vessels (dinghies, village boats, and sailing canoes); no specific concerns with liquid and solid wastes. 3. The project is only concerned with small boat access to the shore (near the market); air pollutant emissions from larger vessels or shore facilities are not a concern. 4. Dredging is not anticipated. 5. The project will improve fuel storage and security in Daru, reducing theft and spillage which may contaminate water and sediments at the moment; specific measures can also be suggested, as follows: training in fuel handling; strict fuel transfer rules (daytime); contingency plan with adequate fuel spill handling equipment; underground bulk fuel storage on shore. 6. Bulk fuel transfer (instead of drums) may increase the chance of larger losses in the event of a vessel emergency; contingency	✓ ✓ ✓ ✓ ✓ ✓			1. There is extensive use of the shore and intertidal flats at Daru, but this area does not have typical recreational value; the wharf will improve access to shore and use of the flats; bulk fuel storage will require the squatter village to move, but this will occur anyhow, with the construction of the market (expected in October, 2001). 2. The Daru shore is presently used as a toilet by the squatter village and people at the market; the Provincial market project will include toilet facilities which will reduce waste inputs to the intertidal flats. 3. - 4. - 5. The area does not have recreational importance; proposed measures should reduce the risk of fuel spills, in any case. 6. The area does not have recreational importance; proposed measures should reduce the risk of fuel spills, in any case.

Actions Affecting Environmental Resources and Social Values (A)	Damage to Environment and Effect on Social Values (B)	Recommended Feasible Protection Measures (C)	IEE – Negative Effects (D)			Supplementary Comments (E)
			No significant effect (D1)	Significant Effect		
				Small (D2)	Moderate (D3)	
		plan with adequate fuel spill handling equipment will be required; high evaporative losses of petrol and/or diesel will accelerate dispersal.				
Actions Causing Unacceptable Sanitation Conditions in Harbour Area						
<ol style="list-style-type: none"> 1. Inadequate provision of water supply to port facilities and ships. 2. Inadequate management of waste emissions from port facilities: a. liquid sanitary and industrial wastes; b. solid sanitary and industrial wastes; c. gaseous emissions from shore facilities. 3. Inadequate management of wastes from ships, including bilge water, sanitary waste, and garbage. 4. Escape of oil within harbor. 	<ol style="list-style-type: none"> 1. No impact of the project on water supply. 2. No impact. 3. Minimal negative impact on environmental quality. 4. Minimal impact. 	<ol style="list-style-type: none"> 1. Water will be provided by the Provincial market project. 2. Apart from bulk fuel storage, the project does not include port facilities. 3. The project is concerned with small boats, which have minimal waste emissions; solid waste management facilities could be provided at the wharf; high tidal current velocities will rapidly disperse liquid wastes. 4. The project will improve fuel storage and security in Daru, reducing theft and spillage which may contaminate water and sediments at the moment; specific measures can also be suggested, as follows: training in fuel handling; strict fuel transfer rules (daytime); contingency plan with adequate fuel spill handling equipment; underground bulk fuel storage on shore. 	<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>			<ol style="list-style-type: none"> 1. - 2. - 3. The Daru shore is presently polluted; however, there is tidal flushing twice per day which ensures some cleansing; any waste management would provide some improvements in environmental quality in the area. 4. -
Handling of Hazardous Materials Within Harbour						

Actions Affecting Environmental Resources and Social Values (A)	Damage to Environment and Effect on Social Values (B)	Recommended Feasible Protection Measures (C)	IEE – Negative Effects (D)			Supplementary Comments (E)
			No significant effect (D1)	Significant Effect		
				Small (D2)	Moderate (D3)	
<ol style="list-style-type: none"> Dust emissions. Hazardous material (inflammables, explosives, toxic substances). 	<ol style="list-style-type: none"> No dust associated with small boat operations. There is an explosion hazard with fuel storage and transfer; safety of workers and people in vicinity at risk. 	<ol style="list-style-type: none"> No mitigation required. Training in fuel handling; strict fuel transfer rules (daytime); fuel tanks underground. 	<p>✓</p> <p>✓</p>			<ol style="list-style-type: none"> – Risks associated with transfer and storage of petrol and diesel can be minimized with proper training of staff and practice with contingency plans.
Handling of Materials to and from Harbour						
<ol style="list-style-type: none"> Traffic congestion. Hazardous material spills (inflammables, explosives, toxic substances). 	<ol style="list-style-type: none"> Minimal impact on vehicle traffic. There is a risk of spills from petrol and diesel containers at the bulk fuel storage facility. 	<ol style="list-style-type: none"> The project is providing a wharf for small boats, which will not affect vehicle traffic; vehicle access to the bulk fuel storage will have to be accommodated. Training in fuel handling; strict fuel transfer rules (daytime); underground fuel tanks in secure yard. 	<p>✓</p> <p>✓</p>			<ol style="list-style-type: none"> The Provincial market project and the bulk fuel storage facility will have to be co-ordinated to optimize vehicle access to both sites. Risks can be minimized with safe handling of petrol and diesel in proper containers, and the requirement for compliance by customers.
Actions Affecting Local Socioeconomic Parameters						
<ol style="list-style-type: none"> Inadequate housing and services for increasing population. Inadequate health precautions during construction: a. communicable disease hazards from imported workers/carriers; 	<ol style="list-style-type: none"> No direct impact on Daru population expected. No direct impact – local construction workers will be used. No displacement of population or agricultural activities. No impact. Negligible increase 	<ol style="list-style-type: none"> No mitigation or interventions required in housing and service sector. No specific mitigation required, but HIV/AIDS awareness-raising should be undertaken in Daru, similar to other locations, as this is a hub for people in transit. No mitigation required. The wharf will cater to small boats from the surrounding area; an influx of workers or crews from other areas is not expected. 	<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>			<ol style="list-style-type: none"> The project is not expected to cause a population influx; the Provincial market project will force relocation of the squatter village on the shore, which may leave some residual issues, or spillover of concerns, when the bulk fuel storage facility is built; the wharf will provide a significant improvement in shore access for those people using the market. This is a small project, so the size of the construction crew will be small. The project will create efficiencies for

Actions Affecting Environmental Resources and Social Values (A)	Damage to Environment and Effect on Social Values (B)	Recommended Feasible Protection Measures (C)	IEE – Negative Effects (D)			Supplementary Comments (E)
			No significant effect (D1)	Significant Effect		
				Small (D2)	Moderate (D3)	
b. inadequate water supply and sanitation for workers. 3. Changes in land use patterns: a. displacement of agriculture; b. displacement of villages. 4. Immigration of workers and ship crews with different sociocultural values. 5. Excessive noise from harbor operations.	in noise.	5. Noise controls should not be required at the small boat wharf.	✓			people using this area, by providing dry access to the shore during any stage of the tide, allowing their goods for market to be kept clean, and saving time. 4. - 5. -
Actions Affecting Terrestrial Habitats and Resources						
1. Clearing of forest and filling. 2. Establishing borrow area and quarry operation. 3. Disturbance of wildlife and loss of habitat.	1. No impact. 2. No impact. 3. No impact; there is no significant wildlife habitat at the site.	1. No mitigation required. 2. No borrow area needed for project. 3. No mitigation required.	✓ ✓ ✓			1. The shore vegetation at the bulk fuel storage site has been trampled by people at the informal market and squatters. 2. - 3. -
Changes in Coastal Hydrology						
1. Deposition along adjacent coastal areas. 2. Erosion along adjacent coastal	1-2. No deposition or erosion of sediments in adjacent areas is expected.	1-2. The wharf will be constructed on piles and will be transparent to water flow.	✓			1-2. The causeway access to the main wharf has caused sedimentation on the west side of the causeway; the proposed small boat wharf will be located about 100 m further west and should not be influenced by the

Actions Affecting Environmental Resources and Social Values (A)	Damage to Environment and Effect on Social Values (B)	Recommended Feasible Protection Measures (C)	IEE – Negative Effects (D)			Supplementary Comments (E)	
			No significant effect (D1)	Significant Effect			
				Small (D2)	Moderate (D3)		Major (D4)
areas.						sedimentation regime near the causeway.	
Actions Affecting Precious Historical, Cultural, Religious Monuments and Sites							
1. Displacement or submergence of sites. 2. Alterations in coastal zone hydrology and shoreline. 3. Construction of infrastructure.	1-2-3. No impact, as there are no historical, cultural, or religious sites at the proposed site.	1-2-3. No mitigation required.	✓				1-2-3. -
Hazards from Access Roads/Traffic Leaving Harbour							
	Minimal impact on vehicle traffic.	Vehicle access to the bulk fuel storage facility to be controlled.	✓				-
Navigation Hazards from Ships Entering or Leaving Harbour							
	Negligible impact.	The wharf is intended for small boats only.	✓				The bulk fuel carrier will continue to use the main wharf.
CONCLUSIONS							
✓	No significant adverse environmental and social effects caused by the project. No EIA needed, but environmental and social benefits monitoring recommended, as described in Section 5, above.						
	Significant environmental and social impacts as shown in Columns D2-D4. Follow-up EIA needed.						

Annex 3. Environmental Examination Summary Sheet

Initial Environmental Examination Construction of fisheries jetty and fuel facilities at Daru

<i>Province:</i>	Western	<i>Date:</i>	August - September 2001
<i>Latitude (S)</i>	9° 05'	<i>Longitude (E)</i>	143° 10'
<i>Prepared by:</i>	John Carter	<i>Ecotype:</i>	Island
<i>Country:</i>	Papua New Guinea	<i>Loan/TA</i>	ADB Loan 1925-PNG (SF)
<i>Executing Agency:</i>	National Fisheries Authority (NFA)	<i>Category:</i>	Level 1 Activity, PNG Environment Act 2000

The major project components for this Fisheries jetty and fuel facilities development are:

1. Hydrodynamic and geotechnical assessment and studies, as required, to finalise design specifications and details in consultation with the client and which are specific to the site.
2. New Finger Jetty: The proposed finger jetty and pontoon wharf would commence at the existing beachfront between the market and the seafood cold storage facility giving easy access to both facilities. It would extend from the edges of the mud flats some 20 or 30 m beside which would be a pontoon jetty accessed along a flexible ramp. This would assist in ensuring fishermen can carry or wheel their catch safely and be clear of the polluted mud. It would also ensure that their boats could remain tied up at the waters edge and not be left high and dry on the falling tide.
3. Construction: The new finger jetty would involve construction of a timber deck fibreglass pontoon jetty abutting a steel pile fixed timber deck walkway. The walkway would be comprised of vertical tubular steel piles supporting steel stringers and hardwood timber planks.
4. Size: The new finger jetty is estimated to be approx 300 m in length. The pontoon jetty abutting the end of the fixed jetty will be about 30 m in length. Both structures would be no more than 2 metres in width.
5. Capacity: It is anticipated that the proposed new finger jetty will cater for 20 banana boats and free up the cramped barge ramps. The pontoon jetty and flexible ramp would provide suitable and safe access to the fixed walkway which would be required as there is a significant tide variation between high and low water.
6. Bulk Fuel Depot: The current fuel supply shipped to Daru is by 200 litre drums on a regular charter. It was stated by the fuel supplier that the current arrangements were not sufficient to meet the demand. All avenues had been explored without a permanent solution being achieved. Also this method of fuel shipment is more costly than bulk shipment by a tanker or similar. It is recommended that a fuel depot is constructed to meet the demand and reduce fuel costs for the fishermen. The depot would consist of three No. 55,000 litre underground tanks for petrol; two No. 55,000 litre underground tanks for diesel; one No. 10,000 litre underground tank for kerosene; an office, shed and necessary facilities, including secure fencing.

NEED FOR EIA

- Not needed (no further concern with environmental parameter – Level 1 Activity)
- EIA needed

COMMENTS OF THE ENVIRONMENTAL SPECIALIST:

The environmental specialist worked closely with the project engineer to ensure that environmental mitigation is designed into the structures, and that construction best practices are specified.

Consultations were held with business interests in Daru and with government representatives for the fisheries, planning, and administrative functions. Observations were also made of social and economic uses of the foreshore and beach in Daru and the main wharf. A brief group discussion was held with people who were using the makeshift market, with a focus on their specific problems and possible solutions. People accessing Daru by the main wharf were also interviewed. These details have been interpreted and used to inform project design. The information has been directly incorporated into the body of this EIA.

Although an EIA is not needed, a program of environmental effects and social benefits monitoring has been designed and included as part of the project costs. A technical advisor has also been specified to assist PNG nationals with design and implementation of the proposed monitoring program.
