

Department of Commerce and Industry

Pacific Marine Industrial Zone

Environment Impact Statement

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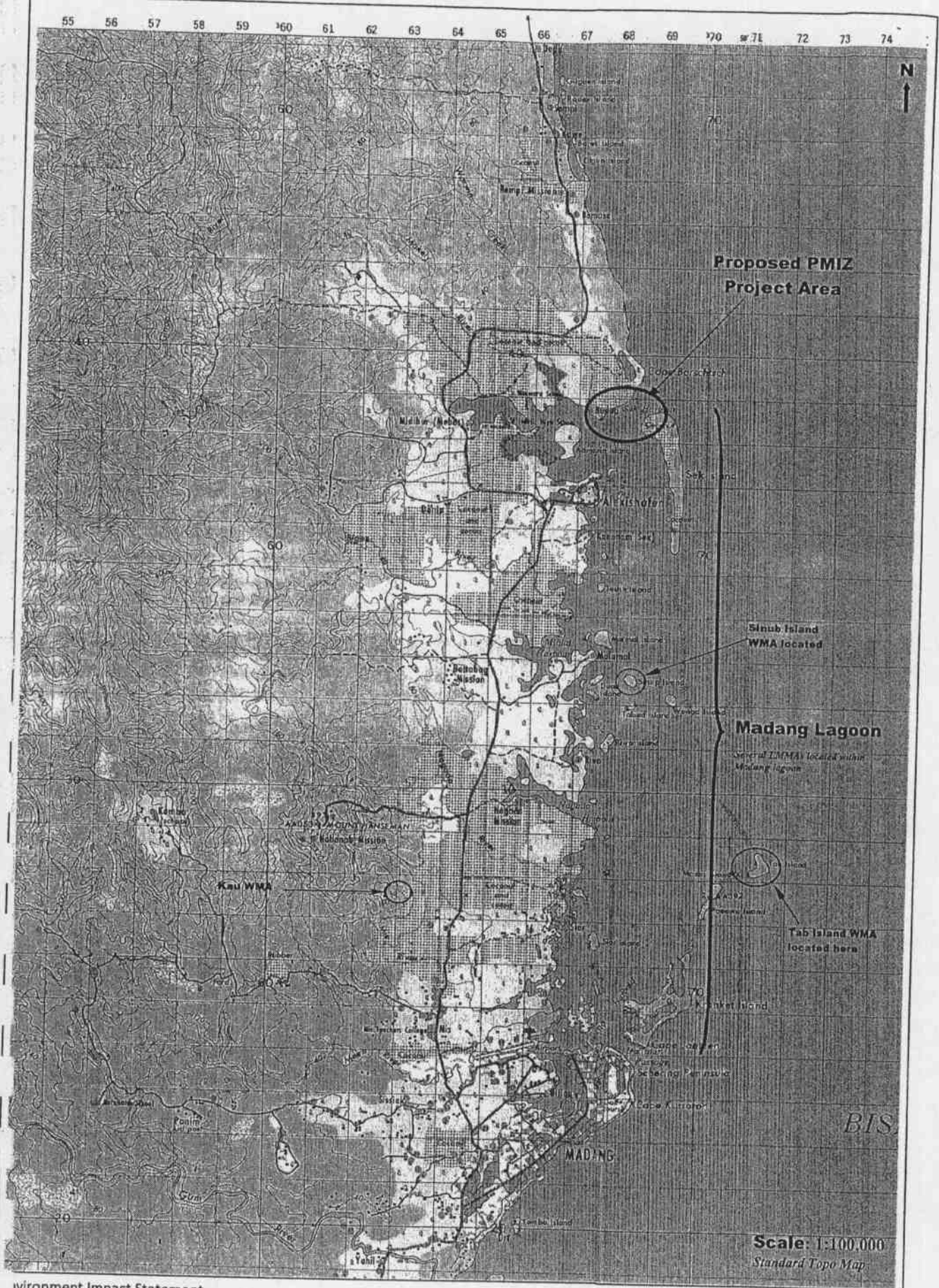
Table of Contents

1.	Executive Summary	2
2.	Purpose of the development	
2.1	Project objectives	7
	Socio-economic objectives	7
	Environmental objectives	7
2.2	Is the project in the best interest of Papua New Guineans?	7
2.3	Consistency with government development priorities	8
3.	Viability of the project	
3.1	Capital costs associated with the project	9
3.2	Details of the proponents technological expertise and resources	9
3.3	Results of any feasibility investigations that has been carried out	9
3.4	Extent of support from impact area communities	10
3.5	Life span and development phases of the project	10
3.6	Viability – the economic context	11
3.6.1	Regional status	11
3.6.2	Financial viability	11
3.6.3	Economic viability	11
3.7	Viability – scenarios for monitoring purposes	12
3.8	Viability – environmental context	12
4.	Description of the proposed development activity	13
4.1	General description of facility setup	13
5.	Development Timetable	15
5.1	Funding arrangement	15
5.2	General requirements and preconstruction activities	15
5.3	Consultation with all affected parties	15
5.4	Development timetable	15
5.5	Development activities for Environment Impact Statement	16
5.6	Closure and rehabilitation schedule	16
6.	Characteristics of the receiving environment	18
6.1	Available environmental studies and investigations	18
6.2	Physical environment	18
6.3	Biological environment	20
6.4	Social environment	24
7.	Waste minimization, cleaner production and energy balance	29
7.1	Waste from site clearance, excavation and construction	29
7.1.1	Site clearance and grading	29
7.1.2	Excavation, dredging and disposal of associated spoils	31
7.1.3	Construction activities	32
7.1.4	Land filling	33
7.1.5	Labour importation	34
7.2	Labour Importation and Permits	34
7.3	Associated socio-economic impacts	35
8.	Environmental management, monitoring and reporting	36

Definitions

Terms and Abbreviations	Definitions
CEO	Community Engagement Officer
CITES	Convention on International Treaty on Endangered Species
DCI	Department of Commerce and Industry
EEZ	Exclusive Economic Zone
EIR	Environment Inception Report
EIS	Environment Impact Statement
EMP	Environment Management Plan
ENSO	El Nino Southern Oscillations
FSM	Federated States of Micronesia
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome
NFA	National Fisheries Authority
NMC	National Management Committee
PMIZ	Pacific Marine Industrial Zone (Vidar Plantation on Portions 1349 and 1350)
SEO	Site Environment Officer
SE	Site Engineer
TPDC	Truk Pacific Development Corporation – <i>A Chinese company based in Philippines that conducted the feasibility study of the PMIZ project. The feasibility study was done in 2008.</i>

Figure 1: Locality Map of Pacific Marine Industrial Zone area



1. EXECUTIVE SUMMARY OR OVERVIEW OF PROPOSAL

The Kiakapan Consulting Services is investigating the feasibility of a project to build and operate a Pacific Marine Industrial Zone (PMIZ) in Vidar Plantation, Madang Province, Portions 1349 and 1350. PMIZ is the project proponent for the downstream component. This document is prepared to satisfy the requirements of Environment Act 2000 in obtaining the Environment Permit to begin work on the project.

The Pacific Marine Industrial Zone is an initiative of the Government of PNG with a goal of increasing export revenue from fisheries products from currently less than 40% to the expected export revenue, to between 80 – 100%. The project is the initiative of the Independent State of Papua New Guinea. The project is facilitated through a partnership arrangement between the National Fisheries Authority, the Department of Commerce and Industry, the Madang Provincial Government and the RD Tuna Canning Ltd. Through NEC decision No. 113/2006¹, a National Management Committee was established headed by the Secretary of the Department of Commerce and Industry (DCI).

The State is proposing to house the project in Madang because of the following reasons:

- Safe place for ships docking and berthing during increment weather conditions;
- Accessibility to the nearby countries: it is also in strategic location as transshipment point for the other Asia – Pacific Region such as Hongkong, Singapore, mainland China, Thailand, South Korea and Japan;

Description of the project

The PMIZ project entails a number of activities to be undertaken. These are:

- The construction of drainage, bridges, roads, etc.
- Wharf and Pier: a total length of 1,165 linear metres.
- Staff housing
- Commercial Complex
- Cool storage: constructed over an area of 8,364m² with a capacity of 10,000 metric tons of fish and meat products. Will hold fish products at temperature range of 0 – 4°C.
- Waste Water Treatment Plant
- Communication and utilities
- Fuel depot: over total area of 3 hectares holding two tanks of 2 million liters' per tank
- Administration buildings: will occupy 720m²
- The Residential Complex
- Container Freight Station and Terminal: Terminal will occupy 8 ha and the Container Freight Station will cover 13,650m².
- Fish Port and Canary: cover 8 ha at cost of US\$50,018,741 (K166,729,136) with an estimated unloading rate of 200 metric tons per day.
- Landfill: to be established 5 km from the project site.

¹See Appendix 1, Annex 2. In this decision NEC approved the formation of the National Management Committee and the National Technical Committee.

Project Viability

Initial capital cost of the project is approximately K250 million (US\$95 million) the project will be funded through a concessional loan of K421 million from the Peoples Republic of China. A China based company will construct the facility.

Feasibility investigations on the financial and economic aspects of the project show the project is very viable. Environmental investigations show that there will be landscape changes and associated effects will arise during the construction phase, however, these will be temporary and disturbed fauna and flora will recover after the construction phase is completed.

Social assessments show that there are issues of contention in relation to land ownership, participation in the project and benefit sharing, environmental degradation, loss of subsistence use of land and sea and various socio-economic and cultural issues. These will be addressed through continuous and diligent consultation during between PMIZ project and its key stakeholders.

Project Development Schedule

The project is scheduled for construction between 2009 – 2011 (3 years). Production is expected to begin by 2012. The lifespan of the project initially as per this plan will be 25 years (2011 – 2036), consistent with the term of loan repayment. As the resource is renewable, the project is expected to continue beyond 25 years. This EIS responds to preparatory work involve land clearing, grading, excavation and dredging and construction of road network, bridges and drainage systems.

The receiving environment

The physical characteristics of the site are conducive for establishment of the project. Although it is near the earthquake prone zone (Pacific Rim of Fire), engineering design will capture this aspect of the area and the facility should withstand these stresses.

The geology of the area consists of Quaternary Alluvium and beach deposits, Wandokai limestones and Kabenau beds. Structures such as faults are not apparent but an inferred lineament is indicated as trending southeast to northwest seemingly along the Kabenau beds. The geological structure is appropriate for establishment of marine industrial zone.

Biological Environment

Madang lagoon is one of the more studied areas along the northern coast of PNG and is conservatively estimated to house over 700 sp of corals and over 1000 species of fishes. The lagoon comprises the following ecosystems: lakes, mangroves along mouths of main river systems and coastline, rivers and streams and brackish lakes, reefs.

Terrestrial ecosystem within the immediate area is highly disturbed. Clearing and grading will not have any significant impact on fauna and flora as the area is cocoa and coconut plantation. The adjacent freshwater lake may be affected as a result of runoff.

The marine and the reef ecosystems are quite diverse in species composition and will be directly affected by sedimentation and turbidity as a result of runoff during heavy rains. However, this effects will be temporary and the ecosystems are expected to recover quickly after construction.

There are also several locally managed marine areas and a couple of Wildlife Management Areas within

the lagoon, namely the Tab Island and the Sinub WMAs (see Figure 1).

Social Environment

Aspirations of people within the impact area like many other areas in PNG are to seek improvement of livelihood conditions while maintaining the best qualities of their natural environment. Impact communities will be affected through loss of land and sea for sustainable use. People seek sound environmental management, adherence to social issues and equal benefit sharing arrangements. Compliance to their basic needs will consolidate their support for the project.

A total of over 30,000 people are estimated to be employed by the project once in full operation. Priority will be given to impact communities for both technical and general labour employment opportunities.

Environmental and Socio-economic Impacts

A number of environmental impacts are identified for the site clearance and construction phase of the project. These include:

- Degradation of water quality
- Destruction of habitat and subsequent loss of species
- Soil erosion
- Increased runoff
- Increased risks of land spillage and eventual toxic contaminations
- Disturbance of endangered species, especially the marine species of reefs, fishes and mammals
- Toxicity from leaching
- Eutrophication
- Dust

The associated human and health issues include:

- Public health risks: as a result of sewage spillage from workers disposals (sanitation problems)
- Welfare related losses of subsistence use of land, recreation and local economic opportunities
- Destruction of cultural sites, tourism potential and aesthetic values of the area
- Transmittable diseases

General mitigation approaches to be employed include:

- Siltation controls using silt curtains, settling ponds and appropriate technology if available
- Drainage barns and settling basins for grading controls
- Option for relocation of displaced populations
- Construction of proper accommodation and latrines
- Awareness among workers and community on transmittable diseases such as HIV/AIDS and other sexually transmitted diseases, water borne diseases such as cholera and dysentery.

Environmental Management and Monitoring Plan

The environment management plan captures the various potential environmental and socio-economic issues and impacts and recommends management approaches to minimize these impacts. Components the Management Plan include:

- A project Management Unit is to be established which will have a Project Manager and personnel. Important personnel for environment management include the Site Environment Officer, the Community Engagement Officer and the Site Engineer;

- An environment management system is to be developed prior to construction beginning, as it will assist tracking and monitoring performance of the environment management plan;
- A monitoring program of the Environment Management Plan is as shown in Table 1 below:

Table 1: Environment Management and Monitoring Procedures

Environmental Element	Monitoring Activity	Timing	Responsibility
Preconstruction planning	Completion of pre-construction management actions	Weekly	SEO
Training and awareness / induction	Regular evaluation of training and awareness program to ensure relevant topics are covered	Annually	SEO / CEO
	Survey of impact area communities to see if awareness information had been understood	Annually	SEO / CEO
	Record of issues arising from or after induction	Monthly	SEO
Community and Stakeholder Consultation	Regular inspections of construction work	Daily	CEO
	Review of complaints register & determine types of complaints	Weekly	CEO
Marine and Terrestrial Ecosystems	Visual monitoring of sediments plumes in water columns	Daily	SEO
	Water quality sampling (pH, turbidity, oils, etc..) for impact area & protected areas	Weekly	SEO
	Check to ensure construction is with boundaries of the project	Weekly	SEO
	Collection and preservation of animals and plants obtained during construction work	Daily	SEO
Pest and Weed Control	Observation around construction area / project for occurrence / pictures to be taken	Weekly	SEO
	Baseline study to identify existing weeds and exotic species	Daily	SEO
Erosion and Sedimentation Controls	Observations on shoreline erosion and sedimentation	Weekly	SEO
	Water samples: (pH, dissolved oxygen, turbidity, oils, litter, etc..)	Weekly	SEO
	Marine biota (assessment of species composition and abundance) – indicator species	Six monthly	SEO
Ground and Surface Water	Monitoring of spill kits available	Weekly	SEO
	Check on equipment to ensure functionality	Daily	SEO / SE
Air Quality	Review of register of complaints related dust problems	Weekly	SEO
	Baseline information on existing dust concentration in air	Weekly	SEO
Noise and Vibrations	Review register of complaints from communities and stakeholders	Weekly	SEO / CEO

Table 1: Environment Management and Monitoring Procedures Conti..

Environmental Element	Monitoring Activity	Timing	Responsibility
Waste Management and Minimisation	Visual inspection of the project area on waste disposal activities	Weekly	SEO
	Review of register of complaints on waste management	Weekly	SEO
Hazardous Materials	Daily checks of all closed (bunded) areas and drip trays	Daily	SEO
	Inspect register of hazardous materials to ensure records are current	Monthly	SEO
Emergency Response	Keep records of weather patterns, earthquakes, climate, etc..	Daily	SEO/CEO
Socio-economic Impacts	Review of record of meetings held with communities	Monthly	CEO
	Review of record of complaints and issues	Monthly	CEO
Review Mechanisms, Records, Auditing	Review of Environment Management Plan	Annually	SEO/CEO

2. PURPOSE OF THE DEVELOPMENT

2.1 Project Objectives

The overall objective of the project is to increase income generation opportunities for the state to be able to meet its demands and obligations to people of PNG. At local level the project aims at improving income opportunities for impact area communities as well as improvement in general livelihood conditions of the people.

Socio-economic Objectives

- 1.1.1 To maximize economic benefits of the marine resources especially tuna for PNG and its proposed partners/stakeholders;
- 1.1.2 To create economies of scale good enough for the locators of the proposed Marine Industrial Zone to be internationally competitive;
- 1.1.3 To establish a competitive regional common service facility for all Pacific Island Countries to consider as an investment opportunity that will serve as a major off loading center for tuna caught from within their respective fishing grounds;
- 1.1.4 To promote development of fishery and set up a linkage development of the fish industry;
- 1.1.5 To drive the fast development of manufacturer industry and provide more jobs to local people

Environmental Objectives

The environmental objectives of the project are:

- To ensure compliance with all environmental regulations of the state and to monitor impacts of development activity and incorporate corrective measures throughout the life of the project;
- In the site preparation and development work the project objective is "to formulate a maximum space planning and strategy to maintain ecological balance and environmental soundness and stability (Truk. Pac. Dev. Corp, 2008, pp126).

2.2 Is the project in the best interest of Papua New Guineans?

The project has at its core and underlying reasoning as improvement of livelihood conditions of Papua New Guineans. The project is designed consistent with the National Constitution of PNG as enshrined in its Five National Goals and Eight Directive Principles. The project satisfies all the five national goals, especially the Fourth National Goal which declares Papua New Guineans commitment to sustainably manage their environment and natural resources and reads:

"We declare our Fourth Goal to be for Papua New Guinea natural resources and environment to be conserved and used for the collective benefit of us all, and be replenished for the benefit of future generations."

This project business product is 'fish' and other marine resources which are renewable resources if utilized in a sustainable way. The fisheries resources of the Western and Central Pacific Region especially Tuna will be the target product. Management regime of this project will require greater level of monitoring to ensure harvesting of this resource does not exceed maximum sustainable yield or harvest. To be able to en-

sure this is so, requires greater level of negotiation, research and discussion among partners within PMIZ and at bilateral and multilateral level by governments of participating nations.

At local and provincial level the project has greater potential for positive socio-economic impacts. However, it requires better and open level of consultation among stakeholders including impact area communities. On the economic front, the project is envisaged to gross, K2 billion annually, a very significant contribution to the national income.

2.3 Consistency with Government Development Priorities

The project actualises many of the requirements of the National Constitution and the National, Provincial and District Development Strategies and Policies. Among these are the Five National Goals of the National Constitution. Some important national, provincial and district development strategies and/or policies include:-

- (a) The *Medium Term Development Strategy (MTDS) 2005 – 2010*. This focuses on economic recovery, growth and development through export-driven economic growth and rural development, poverty reduction and empowerment through human resource development.
- (b) The *National Agriculture Development Plan (2008 – 2016)*. This focus on achieving economic development through export driven actions. Fisheries sector was also captured in this plan as a significant product for development to achieve income generation through export earnings.
- (c) The *National Biodiversity Strategic Action Plan 2000* by streamlining recommendations and strategies specified in other national policies and strategies such as the MTDS 2005 - 2010, The National Agriculture and Livestock Policy 2007 - 2012, National Food Security Policy 2000 – 2010, National Health Policy 2000 – 2010, Forest Policy, Eco-Forestry Policy, Education Policy and the draft Carbon Trade Policy 2005.

Indirectly, the project will be responding to requirements of other policy requirements such as:

- (a) The *Integrated Community Development Policy, 2007* by its commitment to encourage wider stakeholder participation and involvement of rural community as well as the capacity building plans it has in place through community learning and development centres (CLDCs).
- (b) The *National Youth Policy, 2007 - 2017*, through its commitment to provide training and awareness among rural communities of whom approximately 30% are youth, who will form the bulk of the workforce in the project.

At provincial level the project responds to income generation needs of the provincial government. It is consistent with policies and strategies of National Fisheries Authority in enhancing and increasing income generation through fisheries development.

3. VIABILITY OF THE PROJECT

3.1 Capital Costs Associated with the Project

The project will be implemented in two phases²:

Table 1: Summary of project phase and cost

Phase	US\$	PGK	%
1	95,000,000	268,361,581.92	59.33
2	65,127,762	183,976,728.81	40.67
Total	160,127,762	452,338,310.73	100.00

The total cost of establishment of the project is currently being estimated at K 500 million. As per Table 1 above it is K452,338,310.73. The initial setup cost over the first five years (especially Phase 1 will be US\$ 95 million (K268,362,581.92). The cost applies for all basic setup facilities as per this development proposal (see Section 4.0 and Section 5.0). Components of Phase 2 will also be developed as the project develops.

3.2 Details of the proponents technological expertise and resources

The project proponent is the Independent State of PNG represented through the Department of Commerce and Industry (DCI). DCI has capacity to administer and establish the project through funding support from the government of PNG. Technical expertise needed to construct the facility will be sourced through the formal tender process. The selected contractors will be those with relevant skills and resources for clearance and construction of the basic facilities such as road network, wharf and other utilities.

In order to facilitate the development of the PMIZ project, the National Government is sourcing funding from the People's Republic of China through a Concessional Loan arrangement for a 25 year loan repayment period. As part of the bilateral agreement an engineering and construction company from China will construct and establish the Industrial Zone facilities.

3.3 Results of any feasibility investigations that has been carried out

Several feasibility investigations were carried out on the project. These include the following:

- (a) **Engineering Investigations:** Initial investigations during the feasibility studies phase indicate that the site is highly suitable for establishment of the Pacific Marine Industrial Zone.
- (b) **Economic Analysis:** Result of analysis by Truk Pac. Dev. Corp. (2008), the Engineering consultants, concludes that the project is financially and economically viable.
- (c) **Environmental Investigations:** There will be significant alteration of landscape as a result of excavation initially during site preparation. The reef ecosystem within the immediate area will be affected as a result of dredging and excavation activity. However, the impact will be temporary and is limited within the immediate area of the project.

The land area where the project will be located is currently cocoa and coconut plantation and had been under commercial activity for over 100 years. Effect on natural fauna will be minimal.

² The data is taken from Truk Pacific Development Corp. (2009), Feasibility Study. The PNG Kina (PGK) rate is calculated from rates of 26th May 2010 at US\$0.3540 = PGK1.00.

- (d) **Social Investigations:** Socio-economic impact assessment is currently still being done. However, initial investigations shows that benefits to impact area communities will be quite significant. However, there exist many concerns that needed to be addressed by the project, which includes clarification of landownership, level of participation and ways of participation by impact area communities. The local people appreciate the project and will support it, if issues of land, participation and environmental degradation are clearly addressed.

3.4 Extent of support from impact area communities

Communities surrounding the project area portions 1349 and 1350 (Figure 1 (locality), Appendix 3³ (site layout plan) are referred to here as impact area communities primarily because the land on which the project will be housed is state land. This issue of landownership is still in contention as the impact area communities argue that land was acquired fraudulently (see Appendix 4). Communities are opposing the project at this establishment phase essentially because of poor consultation and involvement in the planning stages. It is important that communities are clear on the scope of the project, its positive and negative implications, how they will participate and the methods that will be applied to mitigate environmental and socio-economic impacts of the project.

Furthermore, these communities are concern that the resources that will be harvested and marketed will also be taken from the local landowners coastal and sea boundaries. The impacts of the project, both environmental and socio-economic will extend beyond the directly affected communities (especially Rempi, Kananam, Siar and Riwo villages). From the various consultations with these impact area communities and civil society organizations some key issues were raised that require attention. These are captured in Appendix 4. Most important and immediate issues of concern are the clarification of landownership issues and relevant compensation arrangements, environmental and socio-economic issues and mitigation measures.

In summary the consultations with communities indicate in general mixed feelings among different communities. Community representatives of Kananam Village are adamant that the project will have largely negative impact both on environmental as well as socio-economic. They base their conclusion from current RD Tuna experience. However, there are also members of the same community who believe that the project would bring economic development options for their benefit; however, they prefer that they be integral part of its planning and establishment. They prefer that that project be facilitated in a more open and transparent way where they are informed of what is happening and its impacts. Similar sentiments were also pointed out by members of other impact area villages such as Rempi.

It is thus important for the project to refocus its approach to dealing with impact area communities and begin looking at putting in place compensation and development plans for these communities over a period of time.

3.5 Life Span of the Project

The project is planned for an operational arrangement for a period of 25 years (the duration of the long term loan arrangement). Financial and economic analysis done took into consideration this period. As the tuna and other marine products are renewable resource under proper management, the project is expected to exist beyond this loan period.

³ Appendix 1 of Environment Inception Report is the "Site Layout Plan" within Portions 1349 and 1350. The site is the Vidar Plantation Area.

3.6 Viability – economic context

The economic viability of the project was determined by studies undertaken in the feasibility study by Truk Pacific Development Corporation (TPDC), 2008. Discussions below on economic viability of the PMIZ project are obtained from that document.

3.6.1 Regional Status

Economic viability assessment of the project was undertaken by Truk Pacific Development Corporation with highly favourable conclusions that deemed the project economically viable (Truk Pac. Dev. Corp., 2008). The PMIZ location is Madang is strategic as a transshipment point for the Asia – Pacific Region such as Hongkong, Singapore, mainland China, Bangkok and South Korea and Japan.

Economic data on supply of tuna harvest indicate that the Pacific island nations control some 15 million square miles of the worlds Exclusive Economic Zones. From this the pacific produces 2.7 million tons or 64% of global tuna harvest. Ninety-eight percent (98%) of this total pacific tuna harvest and over 60% of the world total comes from the EEZs of FSM, Papua New Guinea, Kiribati, Solomon Islands, Nauru, Tuvalu and Marshall Islands. Of this FSM provides 28%, PNG provides 21% and Kiribati 20% of the total catch. It is clear that the pacific island nations comprise the largest tuna resource in the world (Truk Pac. Dev. Corp., 2008).

The feasibility study also goes on to mention that while the tuna fishing industry is growing yearly, recent conference on Global Tuna Market in Bangkok was told that, skipjack is by far the main tuna species followed by the yellowfin. However, the yellowfin is at risk of being over-fished. The report also stated that the blue fin and the bigeye are also under stress.

3.6.2 Financial Viability

A detailed analysis conducted concluded that the project financially viable (see Truk Pac. Dev. Corp., 2008, pg 253 – 264). Start-up funding will be provided by the People's Republic of China through a designated China Bank by way of a Concessional/Preferential Loan Package which as reasonable under the following terms:

- Loan period of 25 years, with a 5 year grace period wherein only the interest with the received payment is made;
- Payment shall be in equal semi-annual installments
- Interest rate at 2% per annum
- Loan repayment starts after the official turnover of the completed project.

Financial evaluation conducted based on one locator for a period of 25 year operation and the Sensitivity Analysis on Financial Internal Rate of Return concluded that the project is viable. The viability indicates that the project will be able to service the loan over a period of 25 years. Additionally, the very low interest rate, long term repayment period together with a grace period of 5 years made the project more viable.

3.6.3 Economic Viability

The economic evaluation of the project show that the proposed fish port complex project is feasible. The benefits that will be generated from the project are more than the estimated project cost, even when subjected to sensibility test; the project still generate enough benefits to exceed the hurdle rate of 12%" (Truk Pac. Dev. Corp., 2008, p233).

3.7 Viability – scenarios for monitoring purposes

A number of scenarios need to be monitored and tracked as part of management actions to enable the project maintains its economic viability. Three main ones pointed out by stakeholders include (see also Appendix 4).

- Impact of various mining operations within the country that are or will be doing seabed mining and waste disposal. This could have effect of changing water quality. The change in water quality parameters may affect migratory patterns of fisheries stock, especially Tuna.
- Climate change factors may result in affecting water temperatures within the Bismarck – Solomon seas and its major currents. These changes can also affect migratory patterns within the main fishing zones and larger Western Pacific region.
- Socio-cultural issues among impact area communities. The project will continue to face problems among impact area communities if its project design excludes impact area communities. These communities' actions against the project could lead to undesirable impacts such as stalling of project establishment, continuous and unrealistic compensation claims and other outcomes could eventually undermine the economic viable of the project.

3.8 Viability – environmental context

The project will be developed according to the environmental laws of PNG and in compliance with requirements of Environment Act 2000. Important aspect of the project will be its strategies in minimizing environmental impacts in the Lagoon and surrounding area as well as operating an economically viable project at maximum sustainable yields and not exceeding these levels. Such an operation will enable sustainable business operations within the country and western pacific region.

At each development phase of the project different types of impacts are expected as a result of construction and development activity on the land and sea (physical resources). Mitigation measures will be developed at each of those stages of development.

No environmental cost-benefit analysis was done to evaluate the financial gains against the environmental values of the project. This study will be undertaken as part of the monitoring activity of the project during establishment of baseline database of the project. This study will be important when the project is required to begin facilitating compensation arrangements for the impact area communities.

4. DESCRIPTION OF THE PROPOSED DEVELOPMENT ACTIVITY

The project will be developed over 98.387 ha within Portions 1349 and 1350 at Vidar, in Madang (Figure 1 above and Appendix 3⁴)

The scope of work encompasses the following components

- Construction of drainage, bridges, roads, etc...; wharf and pier facility; factory; commercial complex; cool storage; waste water treatment plant; modern facilities for communication; water supply facility; power supply and reticulation; fuel depot; fish market; administration buildings; residential complex; and;
- purchase of plant, vehicles and equipments

This level of activity will require major alteration of the land including excavation and land reclamation at beach front of the area. A detailed engineering study is yet to be done and is being facilitated by the proponent. From feasibility investigations (Truk Pac. Dev. Corp, 2008, pp 125 – 135) the kind of site preparation work will involve:

4.1 General Description of Facility Setup

The industrial zone will be developed in two phases with the main installments as follows:

- (a) The construction of drainage, bridges, roads, etc..**
A drainage system will be constructed and will involve lying of piping leading westerly towards the seaside. The road network was designed taking into consideration adequacy, economy and safety. The main road will have right-of-way of 34m and carriageway of 30m. Secondary roads will have 24m and 20m right-of-way and carriageway respectively.
- (b) Wharf and Pier**
A pier having a total length of 1,165 linear metres or 1.165km will be constructed. Of 349.5 linear metres will be used as raised walkway over water which will be supported by widely spread piles or pillars.
- (c) Staff housing**
The construction of staff housing will provide residency to staff who are working in the zone. The houses shall be designed functionally and conveniently.
- (d) Commercial Complex**
This commercial complex will provide services and opportunities for people living within and outside PMIZ area. These benefits include: supermarket, houses, markets and business or companies. A warehouse will also be constructed as part of this complex.
- (e) Cool storage**
The refrigeration building will be constructed over an area of 8,364m² with a capacity of 10,000

⁴Appendix 1 of the EIR contains the Site Layout Plan of the Project

metric tons of fish and meat products. It will be suitable for holding fish and fish products at temperature range 0 – 4°C. The 'cool storage' facility will have different options for cooling and preserving fish quality. These include block; flake and plate ice.

(f) **Waste Water Treatment Plant**

A waste water treatment plant is will cater for treatment and disposal of waste water and effluents from domestic and industrial activities prior to disposal into environment. The facility will cater for various types of waste materials namely, solids; oil and grease; and biodegradable materials.

An Activated sludge process and the Tricking Filter Processes are proposed to be constructed to treat waste water. Acids, alkalis and organic materials such as paints, solvents, pharmaceuticals, pesticides, cooking products, and so forth will also be treated before discharge into the environment.

(g) **Communication and utilities**

Modern communication facility will be constructed to provide needs for the industrial centre. Important utilities such as power and water will also be established within the PMIZ. The water supply system will have a water storage area after treatment from raw water from source. The Power system will have initial capacity of 1MVA with potential for increase.

(h) **Fuel depot**

Fuel depot will occupy a total area of 3 ha. This will be for the purpose of storage and supply of gas and petrochemical products to users within the Industrial Zone or outside customers. Two main components will be the fuel tanks and the fire station. The fuel tanks will have capacity for 2 million Litres per tank.

(i) **Administration buildings**

The administration building will occupy 720m² area and will provide for the management team to oversee the industrial area.

(j) **The Residential Complex**

The residential complex work will involve site preparation works, roads, electricity, water supply, and other necessary utilities.

(k) **Container Freight Station and Terminal**

The container terminal will occupy an area of 8 ha and will cater for transshipment of cargo containers from one form of vehicle to the other or from trucks to trucks or from ships to trucks and vice versa. A truck and trailer holding area (Container Freight Station) that covers 13,650m² will also be developed.

(l) **Fish Port and Canary**

The Fish Port will cover an area of 8 ha and will be constructed at a total cost of US\$ 50,018,741 (K166,729,136). This is expected to service a huge Tuna based fishing fleet off Madang with an estimated unloading rate of 200 metric tons per day. The site is partially under water and needs to be developed through clearing of debris and dredging for reclamation and foundation construction.

(m) **Landfill**

A landfill area will be established approximately 5km from the project site. This will be used for disposal of waste materials from the operations of the Industrial Zone. This can also be used to reclaim land that is not suitable for development purposes.

(n) **Purchase of materials and plant**

Materials and plant will be obtained following the policy of the financier, China Exim Bank in which 30% of materials and equipment will be obtained locally while 70% is to be obtained from China.

5. DEVELOPMENT TIMETABLE

The development schedule of the PMIZ project is shown in Table 2 below. Described in the section are activities that are going to be done in phase two of the project which are:

- Funding arrangements
- Preconstruction activities and consultation program
- Site clearance
- Construction work

5.1 Funding arrangement

The Department of Commerce and Industry in representing the Independent State of Papua New Guinea is the proponent of this PMIZ project. Discussions and initial approval of this project was given by NEC in 2006 (Attach NEC decision - notification). Other players key players in this project are National Fisheries Authority and the Madang Provincial Government. Funding will be sought to finance this project. Discussion had been held with Chinese Government for initial funding for the project to be sought through a Concessional Loan Arrangement with the EXIM Bank of China. The loan applications are being finalized. Under this loan arrangement the Chinese Government will identify companies from China to construct the PMIZ facilities.

5.2 General Requirements and preconstruction activities

It is proposed that the development of the PMIZ project take five years to set up (2009 – 2013). The preconstruction activities include General Requirements as follows:

- Feasibility study
- Survey and investigations (socio-economic study, environmental impact assessments)
- Relevant permit applications,
- Architectural and engineering design,
- Insurance arrangements, advance payment bond

5.3 Consultation with all affected parties

Site development is expected to begin in the second year and continue over a period of four years. By the fifth, year all construction requirements should be completed.

5.4 Development Timetable

Table 1 below shows the implementation plan over a period of five years. The first five years will involve construction and set up of the facilities. Actual production will come into place after that, (after 2013). The main phases of the project however will include:

- Phase 1: General project requirements and site development: feasibility studies, surveys and site investigations, architecture and engineering design, permits and insurance.
Site development: land acquisition, land reclamation for wharf and port, construction of roads and bridges, other major excavation work, establishment of utilities (water, power, sewerage systems) housing and accommodation facility, landfill area for solid waste disposal.
- Phase 2: Marine Industrial Zone: This will involve establishment of all installments of the Industrial Zone, includes the Locators, Container Terminal, Fuel Farm, Fish Port, Fish Market,

Wharf and Pier, Commercial Complex, Staff housing and accommodation, and Administration Building. It will also include establishment of Telecommunication Facilities, Water Supply Facility, Waste Water Treatment Plant and the Power Supply Facility.

A monitoring and evaluation plan will be developed and refined as part of project management to be overseen by the Project Management Unit and in accordance with the Environment Management Plan (Appendix 1).

5.5 Development activities for this EIS

This EIS will cover the site development activities of the project. After the site development investors are expected to develop separate EIS for each of the facilities set up. These specific activities are listed in Section 4.1 above.

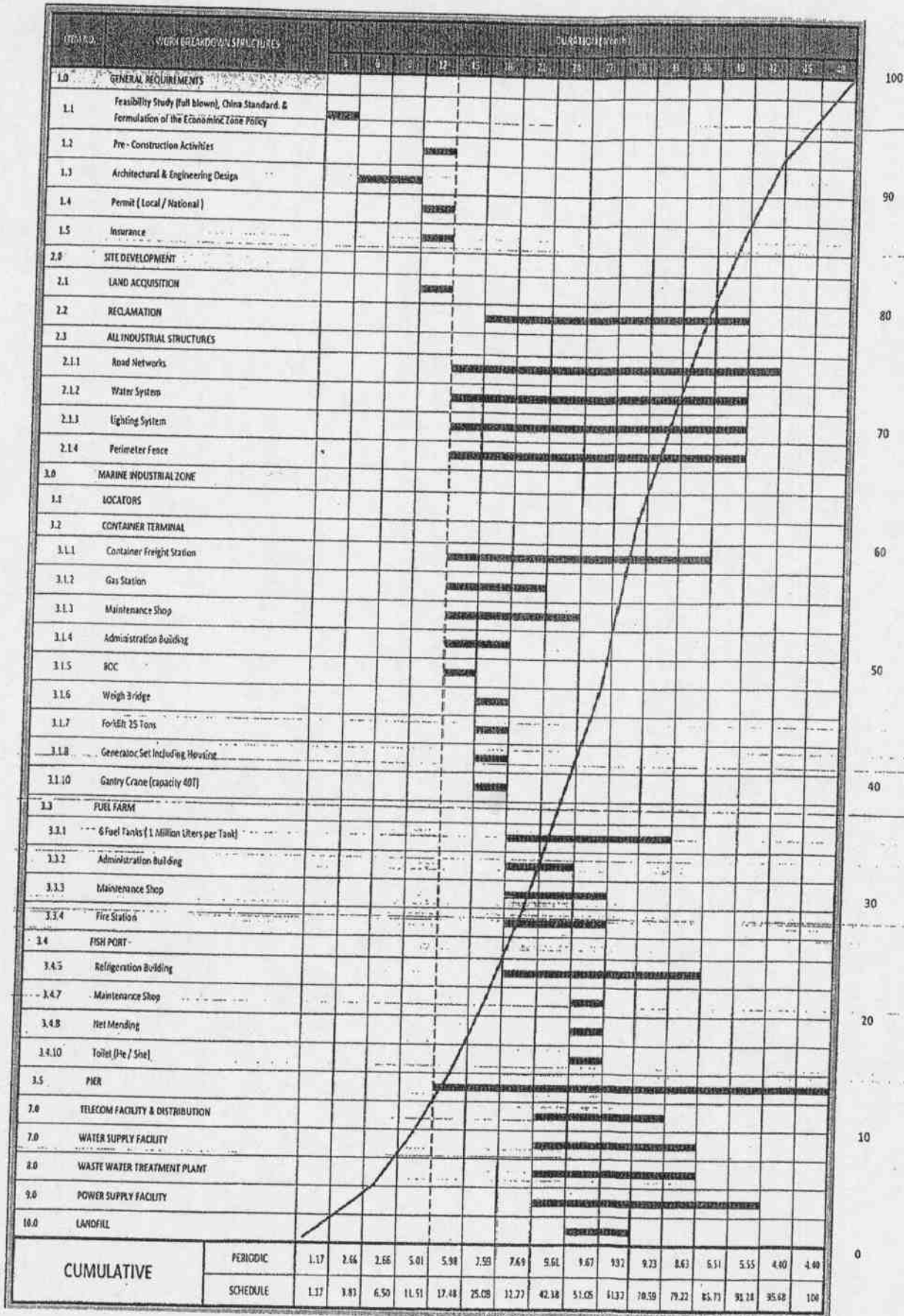
This EIS is therefore being done for the following specific site development activities:

- Land clearance
- Grading and excavation to prepare land for road construction
- Landfill area
- Dredging and filling activity to reclaim land (5 ha) for port development as well as reinforcement of the coastline
- Power supply system
- Water supply system using elevated tanks
- Telecommunication System
- Drainage System
- Sewage collection system

5.6 Closure and rehabilitation schedule

The project is envisaged to have a lifespan further than 25 years. However, a review will be done over segments of 5 year periods to allow the project to realign based on changing environment and socio-economic parameters. A closure and rehabilitation regime is not necessary at this time of the project.

Table 2: PMIZ Development Timetable



6. CHARACTERISTICS OF THE RECEIVING ENVIRONMENT

6.1 Available Environmental Studies and Investigations

Over the last 30 years several significant environmental and ecological studies of the Madang Lagoon area had been done (see Bibliography – Appendix 1). In order to compile this Environmental Impact Assessment, the following investigations were done:-

- (i) Screening and scoping work for PMIZ project by ENREMA Consultants;
- (ii) Environmental Impact Assessment by Kiakapan Consulting Services.
- (iii) Other studies of the area are as shown in Appendix 3⁵

6.2 Physical Environment

Temperature ranges from 28 – 34°C. The dry season is generally from May – September annually. Annual rainfall figures ranges up to 5,000mm in the Finisterre Ranges to an average of 2,670mm in the Bogia District. The province in general experiences humidity levels of 85 – 89%. The two mountain ranges Finisterre and Adelbert are areas of high biological diversity. The Ramu River and the flood plains provide fertile land for agriculture.

The Madang lagoon (within which the PMIZ project will be established) lies on the northern coast of Papua New Guinea (Map, Figure 1) and is one of the very important lagoons that support a very high biodiversity of marine resources and ecosystems. The coastline lies at the nexus of the Pacific, Asian and the Austro-New Guinea geological plates and has accumulated species from all three partially explaining the unusually rich biodiversity (Pandolfi, 1992). The Madang Lagoon is oblong in shape and stretches for 16km from north to south and 4km from east to west (Jebb & Lowry, 1995; Jenkins, 1999) and the largest and the most ecologically diverse lagoon along this coast (Chin et. Al., 2008). It is bordered on the seaward edge by a thick barrier reef which drops to 400m depth within 1km of the reef. Within the lagoon, the bottom is a constant 30 – 40m depth apart from numerous patch reefs and coral islands. The mean water temperature is about 28.3°C on the inner edge of the lagoon with temperatures on the outer edge about 0.5°C cooler. Salinities are around 33 – 35 ppt. Tide ranges varies from 0.2 – 1.1m during an annual cycle and tidal flats are absent. Rainfall varies from around 2,500mm in dry years to 4,500mm in wet years and local weather is strongly influenced by the El Nino Southern Oscillation (ENSO) event (Jebb & Lowry, 1995).

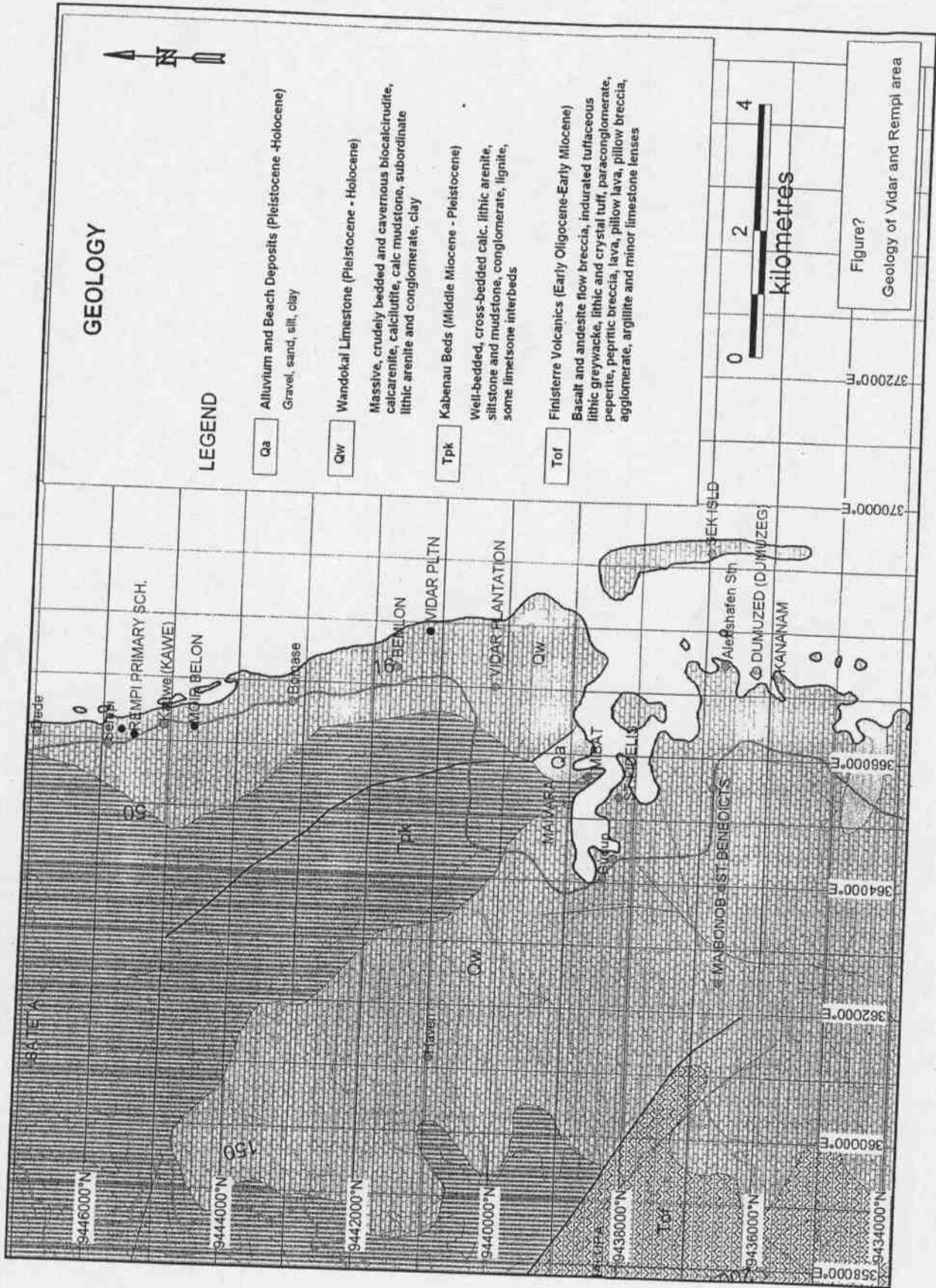
There are five islands within the lagoon which lay on the barrier reef system, one borders the northern end of the lagoon (Sek Island) and the other four border the southern one third of the lagoon (Tab, Maz-zaz, Paeowai and Krankett from north to south) (Asoh, 2005).

Geology and Geomorphology

The geology of the study area consists of Quaternary Alluvium and Beach deposits, Wandokai Limestone and Kabenau Beds (Robinson, et. al, 1976). Figure 2 shows the geology of the proposed industrial site.

⁵ Appendix 5 of the EIR is the "Bibliography" of relevant research and studies undertaken in the project area. These are used in preparing the EIS application at different stages of the process.

Figure 2: Geological Map of PMIZ Project area



The Alluvium and Beach Deposits (Pleistocene to Holocene) consist of gravel, sand, silt and clay. These materials occur mostly on the shoreline and in the mouth of the Makely River.

The Wandokai Limestone (Pleistocene to Holocene) consists of massive, crudely bedded and cavernous biocalcirudite, calcarenite, calcilutite, calcareous mudstone, minor lithic arenite and conglomerate, and clay. The Wandokai Limestone occurs predominantly along the low-lying flat areas and the offshore islands in Sek Harbour.

The Kabenau Beds (Middle Miocene to Pleistocene) consists of well bedded calcareous lithic arenite, siltstone and mudstone, conglomerate, lignite and some limestone interbeds. The Kabenau Beds occur to the west of the proposed industrial site and extends further northwest into the hinterland west of Rempi Primary School.

Structures such as faults are not apparent but an inferred lineament is indicated as trending southwest to northeast. It follows the general alignment of the Warwin Creek channel northeast of the proposed industrial site. The structural lineament seems to occur within the Kabenau Beds.

The proposed industrial site lies within a coconut and Cocoa Plantation which is part of the Vidar Plantation. The site is relatively flat for about 5.0 km from the entrance of the Sek Harbour and the relief gradually increases to more than 100 m further inland.

The Makely River and a tributary of the Warwin Creek form an estuary in the proposed industrial site. Most of the vegetation along the coastline in the harbour consists of mangroves and marshland shrubs. The estuary is part of a medium rainforest which covers an area of approximately 1.0 km².

6.3 Biological Environment

The PMIZ project is located within the Madang Lagoon area towards the northern end (Figure 1). The PMIZ project will be located within the coastal and marine environment within the Madang Lagoon. Madang province is located along the northeastern coast of Papua New Guinea which is known to be a "hot spot" for marine benthic invertebrates within which it has been found, many taxa tend to attain their highest known species richness (Kohn, 2001). Madang Lagoon is oblong in shape and stretches for 16km from north to south and 4 km from east to west (Jebb & Lowry, 1995) and is the largest and most ecologically diverse lagoon along this coast (Chin et al., 2008). The mainland Madang coastline borders its west edge and its east edge is bordered by a narrow barrier reef. There are five islands within the lagoon which lay on the barrier reef system, one borders the northern end of the lagoon (Sek Island) and the other four border the southern one third of the lagoon (Tab, Mazzaz, Paowai and Krankett from north to south) (Asoh, 2005).

The Madang Lagoon area comprises terrestrial, coastal and marine environment types. Each of these environment types will be affected by the PMIZ project. Figure 3 below contains general description of the main ecological features of the whole Madang Lagoon area emphasizing on the existing and the proposed protected areas.

(a) Terrestrial Environment

The terrestrial environment that will be directly affected by the project extends from the coastline to approximately 3 km in land. This land area is highly disturbed as it is currently the Vidar Coconut and Cocoa Plantation which had existed for over 100 years.

Flora

Floristically, the forest is disturbed such that there is **no natural forest**. It has been converted to plantation forest of Coconut and Cocoa. Appendix 3⁶ shows the list of common plants and animals noted during the initial scoping of the area. Socio-economically important species include *Pandanus*, sago palms and trees such as the Kwila which are used by local people as food source and for construction of houses. **As the project involves wholesale clearance and excavation, all these floral species will be removed.** There will be no impact on natural flora as the area is disturbed.

Fauna

No natural habitat fauna is expected within the project area. The fauna recorded in the area are mostly highly mobile and those that can easily adapt to disturbed environment. Most common fauna found in the area are shown on Appendix 3⁷ (Kiakapan, 2009b). Of these fauna four species listed as CITES Appendix II were recorded. These are: Rainbow Lorikeet (*Trichyglossus haematoides*), Eclectus Parrot (*Eclectus roratus*), Freshwater Crocodile (*Crocodylus novaeguineae*) and Lizard (*Varanus indicus*).

The habitat of these animals will be altered and the highly migratory ones will migrate to the nearby environment. The lagoon will not be disturbed, however, the activities relating to water extraction will result in some disturbances and some changes are expected.

(b) Coastal Environment and Marine Environment

Madang lagoon is one of the more studied marine systems on the northern coast of New Guinea, is conservatively estimated to contain as many as 700 species of corals and 1000+ species of reef fishes. An amazing variety of new marine species have been discovered in and around Madang Lagoon in recent years, broadening our knowledge of fishes, soft and hard corals, nudibranchs, flatworms, polychete worms, sea stars, feather stars, amphipods and sea cucumber to name a few.

Coastal Environment

The coastal environment within the lagoon is comprises of four different main ecosystems: lakes, mangroves, rivers and streams and brackish lakes.

Lakes: There are four lakes in Madang which are part of its dissected coastline. The limnological characteristics of these lakes were described by Vyerman & Meester Luc (1994). It was found that all four lakes were formed by solution and the subsequent collapse of the fossil uplifted coral reefs but that they vary in salinity, stratification regime and their under water light climate. The lakes are Babel, Nagada, Siar and Sek where the first three are situated in fossil uplifted coral terraces on the mainland while Lake Sek lies on a reef island near the coast (Vyerman & Meester Luc, 1994).

Mangroves: Madang Lagoon's mangroves are concentrated around the mouths of the Miero, Sek, Nagada and Biges Rivers. Most inlets and harbours also contain sparse mangroves within their inner reaches. The highest concentration of mangroves is around the mouths of the Sek and Biges Rivers on the northern mainland edge of the Lagoon (Jenkins, 2002). The common mangrove species along the coastline are *Avicenia marina* and *Rhizophora stylosa* (Kiakapan, 2009a). Mangroves characteristically provide nursery, breeding and feeding grounds for many fishes and invertebrates. They also serve as physical barrier to coastal erosion threats during high tides and storm events. They are also spawning grounds for juvenile fishes.

⁶ Appendix 2 of the EIR is the plant/flora list in the project area.

⁷ Appendix 3 of the EIR is the fauna list of species identified in the area.

Rivers and Streams: There are four major river inlets that feed into the Lagoon, Sek River at the extreme North, the Biges River, the Nagada River and Meiro River at the extreme South. During periods of heavy rain these rivers bring in silty water which generally leaves the lagoon quickly and doesn't mix appreciably. There are several other inputs but these are of minor significance, the catchment behind the lagoon is relatively small. The watershed is about 6 km farther inland (Jebb & Lowry, 1995, In Jenkins, 2002).

Brackish Lakes: There are at least seven known brackish lakes on the surrounding mainland and catchment. None of these lakes have been investigated. Further research is required to determine the biodiversity and other features of the lakes (Jenkins, 2002).

Marine Environment

The marine environment comprises a variety of taxa, classified broadly for this report as sea grasses and weeds, coral, fish, invertebrates, marine mammals, sea turtles and commercial sedentary species. Studies by Wia et. al (2007), Jenkins (2002), Kiakapan (2009) identified several common seagrass species that support a diverse holothurians fauna (18 species). Some of these common species include: *Cymodocea serrulata*, *Halodule uninervis*, *Halophila ovalis*, *Enhalus acoroides*, *Thalassia hemprichii* and *Syringodium isoetifolium*. Several sea weed species were also identified to exist within the lagoon with the green algae being the most common. Common ones identified include: *Caulerpa racemosa*, *Halimeda maroloba*, *H. micronesica*, *H. opuntia* and *Velonia ventricosa*.

Fishes

Marine fauna include fishes, corals, echinoderms, mollusks, crustaceans, reptiles and mammals. Appendix 3⁸ provide detailed listing of notable and common species that occur in within the Madang Lagoon area, especially the within and around Sek Lake (Kiakapan, 2009a). Of the fishes two endemic species were found including the Blackstripe blenny (*Meiacanthus vittatus*) and the Whitespot damselfish (*Pomacentrus albimaculatus*) and at least two globally endangered fishes, the Humphead wrasse (*Cheilinus undulates*) and the Giant Queensland Grouper (*Epinephalus lanceolatus*). Endangered whale shark (*Rhincodon typus*) have also been sighted within the lagoon.

Corals

The Madang Lagoon is said to be the epicenter of marine life abundance consisting of 75% of known coral species. Numerical estimates are as high as 700 species as compared to the Great Barrier Reef. It is thus a significant sub-region within the Coral Triangle Region. Corals identified include both soft and hard corals. Branching *Acropora* and large *Porites* coral heads are most common in stable areas. Steeper drops contain large tabulate *Acropora*, *Montipora* and *Anacropora*. Soft corals are also well represented covering approximately 12% of the area (Kiakapan, 2009a).

Echinoderms

A variety of species of echinoderms are found at the project site such as the sea stars and feather stars. Important economic species found include several species of Holothurians (sea cucumbers). These include *Bohadschia argus*, *Bohadschia graeffei*, *Thelenota anax*, *T. ananas*, *Holothuria fuscopunctata*, *H. edulis* and *Stichopus variegates*. These were noted to be low in numbers possibly because they were harvested unsustainably to be sold to Asian buyers in Madang.

⁸ Appendix 3 is the Environment Inception Report. In this report Appendices 4A & B gives the list of species recorded from the project area.

Molluscs

Two species of CITES-listed Giant clams (*Tridacna croacea* and *T. derasa*) were sighted; however, these are in low numbers. Other species sighted include: Cephalopods such as the reef cuttlefish (*Sepia latimanus*), Bigfin reef squid (*Sepioteuthis lessoniana*) and Common reef octopus (*Octopus cyanea*).

These mollusks species are important source of protein for the local people and also dependent on sea grass, sea weed and reef ecosystem. Destruction of these different habitats will significantly affect the mollusks population. Additionally, pollution from chemicals and waste discharge will significantly affect these taxa as these are mostly filter feeders.

Crustaceans

Previous studies indicate that approximately 180 species of gammaridean amphipoda exist in the Madang Lagoon area. Some common species noted include: Painted rock lobster (*Panulirus versicolor*) existing in only low numbers; Banded Cleaner Shrimp (*Stenopus hispidus*) is relatively common in deeper waters; Manthis Shrimp (*Odontodactylus scyllarus*), snapping shrimps (Alpheidae), cleaner shrimps and symbiotic shrimps (Hyppolytidae), boxer shrimps, hermit crabs (Diogenidae), shore crabs (Grapsidae) and sponge crabs (Dromidae).

Crustaceans are also main group of filter feeders and very susceptible to change in water quality, dissolved materials, including sediments, chemicals and other products. They also form an important food source for local people.

Reptiles

Two species of globally endangered species of turtles were sighted in the project area. These are the Hawksbill (*Eretmochelys imbricata*) and Green Turtle (*Chelonia mydas*). The banded sea snakes (*Laticauda colubrina*) were also sighted in abundance.

Marine Mammals

The lagoon is also home to three different endangered marine mammal species: Dugongs, Spinner dolphins (*Stenella longirostris*), Bridled dolphins (*S. attenuata*) and the Pacific Pilot Whale (*Globicephala macrorhynchus*).

(c) Protected Areas

There are several protected areas within the immediate vicinity of the PMIZ project. These include the Taab, Tabad, Sinub and Laugum Wildlife Management Areas (WMAs) totally over 1,000 ha (Table 2 below).

Table 3: List of Protected Areas within the Madang Lagoon Area

Protected Area	Area (ha)
Taab WMA	984.30
Tabad WMA	16.20
Sinub WMA	11.80
Laugum WMA	72.95
Total	1,085.25

Figure 3: Showing existing and proposed protected areas within the Madang Lagoon area of which Sek Harbour is a part.

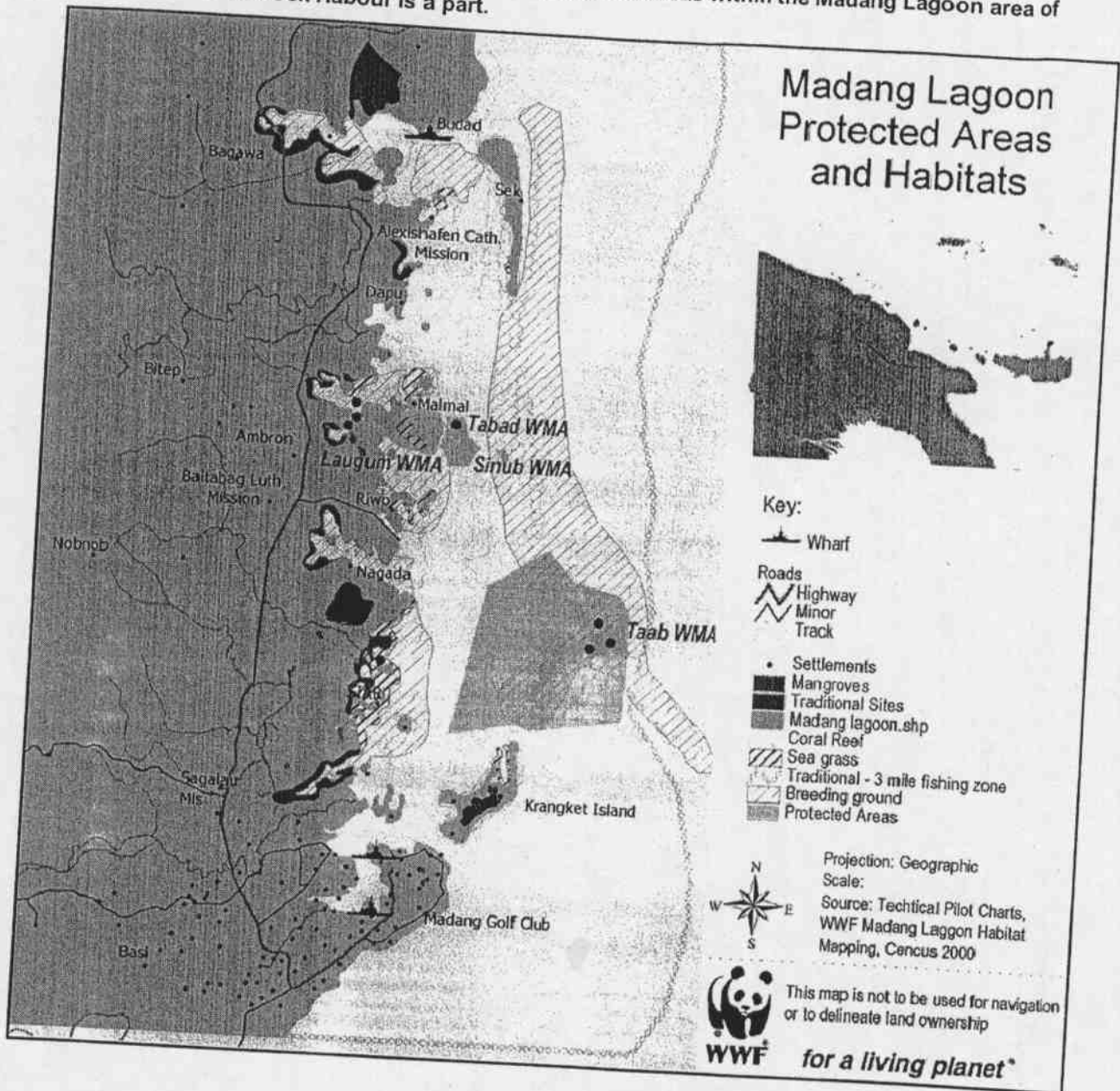


Figure 3 below also shows proposed protected areas currently being facilitated as "Locally Managed Marine Areas" (LMMAs) by the local communities (impact area communities) in partnership with civil society organizations (The Nature Conservancy and World Wildlife Fund for Nature Conservation (WWF) – PNG Office). These areas are established under consultation with local people with the aim of protecting the important biodiversity in the area. There are several endangered species of marine life that needs to be protected and these resource management approaches allows for these species to be protected.

Most of these proposed areas are located within the vicinity of the four existing WMAs towards the southern part of the project. The PMIZ project activities may not directly affect these WMAs.

6.4 Social Environment

The socioeconomic impacts of a proposed development on a community may actually begin the day the project is proposed⁹. Changes in social structure and interactions among community members may occur once the new development is proposed to the community. In addition, real, measurable and often significant effects on the human environment can begin to take place as soon as there are changes in social or economic conditions¹⁰. In the case of the PMIZ project, people have formed their opinion of the project on announcement of the project primarily based on their experiences over time.

Socioeconomic impact assessment is designed to assist communities in making decisions that promote long-term sustainability, including economic prosperity, a healthy community, and social well-being. This section points out some current status of socio-economic environment within the proposed project area of PMIZ. The following indicators were therefore used:

- changes in community **demographics**;
- results of retail/service and housing **market analyses**;
- demand for **public services**;
- changes in **employment and income levels**; and, changes in the **aesthetic quality** of the community.

No detailed quantitative data was collected in this assessment; most of the emphasis was put on documenting people's perceptions and view on the project (Appendix 4). The preliminary data obtained from the studies undertaken by the environment impact assessment team are analysed and arranged to capture these important socio-economic indicators. Conclusions derived are general and may require a detailed socio-economic study to be conducted¹¹.

6.4.1 The findings

A detailed summary of the findings from the consultation undertaken with the impact communities and civil society organizations are presented in Appendix 4.

These findings are divided into the following sample assessments based on the proposed project's, size, location, socio-economic characteristics of the impact communities: (i) general socioeconomic assessment; (ii) demographic impacts; (iii) housing market impacts; retail development; assessing the impacts on employment and income; assessing the current accessibility of public services; and, (iv) elements of design review.

General Socioeconomic Impacts

General

- The communities want to maintain their cultural way of doing things, better living standards access in terms of amenities and services and less impact on the natural environment.
- The communities want better quality of life in terms of clean environmental, good jobs, arts and cul-

⁹ The socio-economic impact study is an important quantitative measurement and supposes to be conducted prior to this environmental impact study. In this case the one prior to this one, did not provide the basis in which this study will build upon.

¹⁰ From the time of the earliest announcement of a pending policy change or development project, attitudes toward the project are formed, interest groups and other coalitions prepare strategies, speculators may lock up potentially important properties, and politicians can maneuver for position.

¹¹ At the time of preparation of this EIS, the Socio-economic Study is being tendered for consultants to be engaged to conduct the study.

- ture, security and safety, good relations with neighbors in their respective communities.
- The quality of life has not seen significant improvement for last 20 - 30 years because of governance related issues.
- People within the impacted areas are mainly low-income earners and feel that their quality of life is disproportionately affected by the captioned project.
- People want equal distribution of benefits and participation as active partners in development project.
- People argue that their claim to the land needs to be considered seriously as it will affect their livelihood over long term in relation to the captioned project.

Demographic Impacts

The demographic impacts include the current existing population within the impact area and the new migrants into the project area as a result of this captioned project. Factors that will be affected include density and distribution, composition of the population in terms ethnicity (both nationals and foreign workers and migrants), age, gender, wealth, income, occupational characteristics, education levels, health status, etc... Given the proximity of the project area and accessibility, migrant population will become of the major impacts, a major concern by the local impact area communities. The following observations are noted:

Demographic Impacts

- From the National Census 2000, Ambenob LLG population is 42,866 from a total of 7,137 household units of which male population makes up 53%. At a provincial growth rate of 2.7%¹² (from 1980 – 2000 census), this population is much higher.
- 30% of the above is youth population of both female and males (extrapolated from data provided in National Youth Policy, 2009).
- There will be influx of temporary workers during the site preparation phase of the project.
- Current household average for children is 4.

Housing - Market Impacts

The project is not likely to impact the impact area communities' housing needs directly. However, as part of its spin-off effects and general contribution to livelihood improvement the project is expected to improve housing. No specific mention of housing needs were brought up by the communities consulted.

Local Housing Market Affects

- The development will help to provide housing for its workers but will not directly facilitate housing for the impacted communities.
- There is a need for affordable housing in the community; however, there are no clear directions as to whether the project will assist in housing.
- The development is easily accessible to public and private facilities and services, such as retail establishments, parks and public transportation.

Retail Market Impacts

The growing population as a result of the project will attract new commercial developments in and around the project. The project itself will establish retail shops and markets for nearby population. The communities expect to participate in these retail businesses as partners. However, general observation shows that the communities may need additional support in resources such as knowledge and skills, start up cash capital, transportation and others. General observations show the following:

¹² The 1980 – 2000 census estimate is used as the 1990 – 2000 figures are affected by figures from Bougainville as a result of the civil crisis (Source: National Statistics Office, *Data Sheet*, PNG 2000 Census Figures).

Aesthetic Impacts

Aesthetic value of the area in which the PMIZ project is to be established is quite significant in that it is a naturally picturesque area, rich in marine biodiversity. The area is highly valued and regarded for its tourism potential. Additionally as pointed out in the above sections (6.3 – Biological Environment) is significant marine ecosystem along the northern coast of New Guinea. Its rich coral and fish species diversity is one of the highest and the most significant. Below are the observations based on the design of the project during and at the time of this study on design of the project. There needs to be emphasis on maintaining a greater aspect of the areas aesthetic significance.

Elements of Design Review

- The proposed development will provide the surrounding communities with migration of skilled workers with new knowledge, skills, money, ideas and business opportunities.
- The proposed development will integrate natural resources, buildings, parking and landscaping that is both functional and maintains the aesthetic integrity of the environment.
- The design and plan does not capture clearly the aesthetic value of the area. There is need for this aspect to be built into the project

Community Perceptions about Social Well-Being: Quality of Life

The attitudes community residents have toward development and the specific actions being proposed as well as their perceptions of community and personal well-being are important determinants of the social effects of a proposed action. Such attitudes are a reflection of the quality of life residents seek to enjoy and preserve, whether it is limiting growth in order to maintain the rural image of a small community; expanding the boundaries of the village; or providing a variety of housing choices to new, diverse residents and businesses. The general community perceptions on the project are noted in Appendix 4 and summed below.

Attitudes towards Development

- There is limited evaluation on the effects of the development on the community attitudes as a result of this captioned project.
The community attitudes are generally supportive towards proposed type of development, but they need to be fully informed on the positive and negative impacts of the captioned project.
There have been controversial issues on landownership, proper consultation between the State agencies, private developer, and the impact communities, and, environmental and socioeconomic impacts of the captioned project raised by impact communities.
The people are willing to accept the project provided that their concerns on landownership, compensations, participation in the spin-offs, benefits sharing, and become active partners in the planning and implementation of the captioned project are judiciously addressed.

Archaeological and Historical Features

The impact area communities will be subject to rapid and much greater intensity of development actions as a result of this captioned project. This rapid increase in activity has potential of altering the landscape and importantly significant cultural and historical sites and geographical and/or physical features. Some important cultural (sacred sites) are shown on Figure 3 above. Most of these sites pointed out are located towards the northern end from where the project is proposed. This is primarily because no detailed social mapping exercise has yet been done on the immediate project area. The freshwater lake at the edge of the project area was reported as a feature of cultural significance and requires further investigation.

Some of the notable observations include:

- There are important cultural and historical aspects of the area that needs to be studied and enumerated (recorded);
- These features to be factored into the project design;
- The long interaction between Missionaries and local people may have resulted in loss of important oral and ethnic history.

6.4.2 Socioeconomic Conclusions

The socio-economic assessment indicates that there is still a great deal that needs to be done in terms of preparation of local communities within the impact area to participate in the project. In this context it is the prerogative of the project proponent and its project management team to consider whether or not the impact area communities are important players in this project.

In the feasibility study and initial concept, involvement of impact area communities in the project planning, design and implementation is not clearly spelt-out. This could have serious implications. In general the socio-economic assessment through consultations identifies the following important recommendations:

- That a clear policy or strategy be incorporated in the project design to engage impact area communities in the development of the captioned project;
- Issues of contention such as the landowners, resource user rights and relevant compensation mechanisms to be considered and discussed among different parties in the project;
- Environmental and socio-economic impact monitoring program be outlined for implementation;
- Archeological and historical features as well as aesthetic significance of the area be considered as important in the design of the project to be able to maximize on all possible economic and

7. WASTE MINIMISATION, CLEANER PRODUCTION AND ENERGY BALANCE

This section makes reference to list of activities that will be undertaken in Phase 1 of the project (Section 4.1 and 5.4). Each of these activities will result in some level of waste production and accumulation. The main waste materials that are anticipated to be produced are described in Appendices 5 – 1 & 2. Possible management and mitigation actions that can be take by the project to minimise impacts of each of these activities are also discussed¹³.

7.1 Wastes from site clearance, excavation and construction

7.1.1 Site clearance and grading

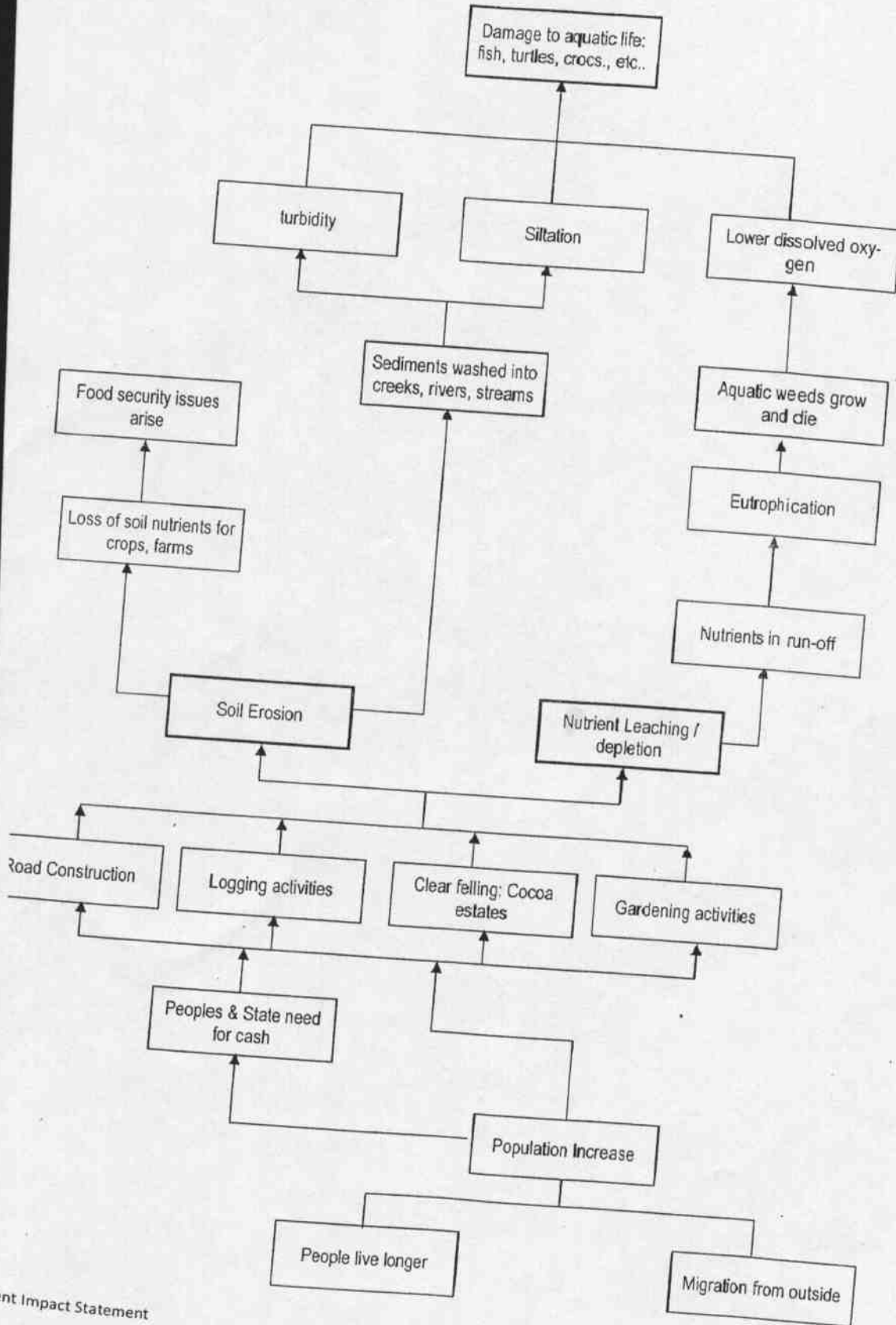
Activity and Environmental Consequences

This activity will involve clearance of the existing re-growth forest and the plantation (coconut and cocoa trees). Machinery involved will be general labour using chainsaws, bush knives and axes, bulldozers and graders and excavation machinery, heavy trucks to move graded debris. This activity will result in the following environmental consequences:

- (i) Denuded landscape

¹³ Adapted from Carpenter and Maragos (1989), pp 205—207

Figure 4: Cause and Effect Diagram showing cascade of effects that could arise as a result of interlinked causes and effects.



- (ii) Altered soil profile
- (iii) Altered topography

A chain of impacts are likely to take place as a result of this as illustrated in Figure 4 below. Environmental consequences as a result of soil erosion from exposed top soil will include increased turbidity, sedimentation, and subsequent destruction of benthic life and accumulation of dredge and excavation spoils.

Environmental Impacts

Soil erosion will be the main environmental impact of land clearance and grading. Runoff is expected increase. It will then lead to degradation of water quality as a result of increased sedimentation and turbidity. This will then lead to destruction of species and their habitats, especially the benthic life (flora and fauna) (see Section 6.3 above). Noise and possible oil spillage from heavy trucks and machinery may also be experienced.

Human Health and Welfare Impacts

The land clearance work will have some significant human health and welfare implications. Near where the project will be established is a freshwater lake that has some important cultural and traditional values. A detailed social mapping exercise can determine the importance of this area. Most or all the land on which the project will be housed is disturbed land and much of cultural and traditional values had been lost over time. The Sek Lake area is part of the bigger Madang Lagoon area that has immense significance in biodiversity, aesthetics and tourism. This potential is likely to be lost.

People from Kananam and Rempi also use perimeter of the plantation area for their subsistence gardening activities and this will be greatly affected. Degradation of water quality as a result of clearance and subsequent erosion, will seriously affect local fishing grounds and nearby / onshore reefs and mangrove systems.

Suggested Mitigation Measures

Environmental Impacts will be mitigated using the following approaches (see also Truk Pac. Dev. Corp., 2008, p221):

- Application of Siltation controls using silt curtains (filter screens), settling (sediment) ponds and as well as application of appropriate technology available.
- Land clearance and grading activity will be scheduled to take place during relatively dry period of the year.
- Based on recommendations of social mapping exercise on archeological and/or sacred sites, the project will redesign and rearrange certain components of the project. For example, the proposal to use the fresh water lake as source of water will need to use appropriate technology management approach that does not lead to wholesale destruction of the freshwater lake.
- Consultation with impacted people of Rempi and Kananam regarding gardening land, local fishing grounds and other related matters. This could lead to instituting an agreement that will enable the communities to benefit from the project and/or some aspects of relocation and other actions deemed appropriate from the negotiations.

7.1.2 Excavation, dredging and disposal of associated spoils

Activity and Environmental Consequences

Excavation and dredging will be done on the cleared land along with grading. This construction activity will involve construction of road network, dredging of sand, gravel and reef within the Sek Lake and reinforcement work along the coastline. This activity will bring about a number of environmental consequences,

namely;

- Turbidity
- Sedimentation
- Destruction of benthic fauna and flora
- Dredging and excavation spoils

Environmental Impacts

Each of the above consequences will lead to several environmental impacts much similar to the clearance and grading action. However, this activity will have much more greater impact in the direct destruction of benthic fauna and flora within the immediate Sek Lake. Indirect impacts include sedimentation on reef, mangrove and sea grass ecosystems as a result of wave action within the impacted area. This activity will result in even greater contribution towards sedimentation within the Sek Lake and Madang Lagoon.

Toxic waste from dredge spoils can be expected if (a) ocean disposal becomes an option for dumping of spoils and (b) leaching of toxic chemicals from dumped material takes place.

Human Health and Welfare Impacts

The nutrient and chemical leaching can have public health risks. Welfare losses such as land and sea for subsistence, recreation and economic use will also be lost or compromised. The Kananam community expressed strongly their loss of land, reefs and sea for recreation, subsistence and economic needs. The productive land for gardening used by the Kananam are adjacent and/or within the Vidar Plantation area. These will now be destroyed and the people will be critically affected. Economic potential of the area through its tourism potential will also be affected.

Suggested Mitigation Measures

The area is selected for its appropriateness with respect to harbour facility as well as its proximity to main fishing grounds within PNG. It is located towards the northern end of the Madang Lagoon. Every effort will be made to ensure impacts are restricted with the Sek Lake area. Siltation controls will also be established to manage levels of siltation as a result of erosion and runoff. The impact will be minimal as the activity will be temporary and continuous wave action should allow for quick removal of silts once the activity ceases. Dumping of dredged and excavated material will be dumped at a designated site for land filling. The land fill area will be managed to ensure minimal leakages and leaching.

7.1.3 Construction activities

Activity and Environmental Consequences

The various construction activities will result in production various things that are or environmental significance;

- Noise from large machinery during clearance, grading and construction
- Dust from disturbed and excavated soil
- Structural addition to coast and landscape
- Machinery emissions
- Oil spills

Environmental Impacts

The main environmental impact that will be degradation of water quality as a result of factors discussed above. Eutrophication can result also due to nutrient leaching and run-off as a result of earlier actions discussed above.

Impacts such as disturbance of endangered species are minimal for terrestrial activities. Noise will not be a problem with marine animals, however, other disturbance factors such as dumping of waste, excess oil /

waste oil will have an impact on habitats and the life forms.

Oil spills and other wastes material from construction activity may contaminate soils and water supply when rains come. Runoff has the potential to contaminate ground, surface, and near shore marine waters.

Human Health and Welfare Impacts

Similar impacts as discussed above are expected to occur during construction. Respiratory irritation may occur as a result of fugitive dust produced from construction activities. There will also be important welfare losses such as change in the way neighbouring communities do things, involvement in subsistence activities and alteration of the general landscape that may affect the aesthetic value of the area. People will permanently lose their recreational areas once construction begins.

As in any other construction activity, there will be risks of worker accidents and therefore concerns will be on safety. People would want to know the organizational arrangements for Workplace Health and Safety. What are the policies in place? What would be the project's policy on workplace health and safety?

Suggested Mitigation Measures

Most of the environmental impacts are temporary and restricted to within the immediate project area. The human health and welfare impacts are however more long term. Loss of recreation and subsistence use of land and sea will be permanent.

The project will put in place several policies and regulations to minimize most of these impacts. Important policy issues will be:

- Policy on *workplace health and safety*. The project must have high standards to protect the interest of workers as well as image of the project. Issues in relation to these were pointed out by stakeholders also (See Appendix 4);
- Control and management mechanisms need to be developed and administered to manage toxic substances that will be used during construction.
- Fugitive dust problem will be managed through occasional wetting of the dry and dusty areas.
- A compensation arrangement be discussed with impact area communities. A fair compensation arrangement would effectively manage negative actions from these communities.
- Conduct participatory meetings with communities to discuss impacts of loss of subsistence, recreation and economic options as a result of this project.

Environmental impacts of construction can be managed by using the following approaches:

- Noise and emission control regulations will be developed to provide for control of emissions and noise produced. All normal daylight hours are working periods and noise produced at that period will be accepted as normal. Any night time operation must be regulated and given operational limits.

7.1.4 Land filling

Activity and Environmental Consequences

Some landfill activity will be done during preparation of construction of the wharf and pier, and reinforcement for shore protection. Additionally, a landfill area will also be established 5km from the project area to cater for solid wastes from construction as well as during operations of the industrial zone. This landfill activity will have some significant impacts on the marine life forms, especially benthic life. Important impacts will be:

- Permanent destruction of benthic life forms;
- Increased turbidity, reduction of light in water column and subsequent loss habitat and species;
- Leaching of toxic materials for land based dumping at landfill area.

Environmental Impacts

Improper discharge of waste by humans will affect water quality seriously through increasing biological oxygen demand that could eventually lead to Eutrophication and destruction of aquatic and marine habitats which can lead to loss of species. In the case of the PMIZ, selection of a dumping site is yet to be done. Leaching of toxic chemicals and materials from land fill areas on land could result in degradation of rivers and streams and subsequent loss of species.

Human Health and Welfare Impacts

Leaching of toxic chemicals and materials will also lead to public health risks such as effects of poisonous chemicals and bacterial infections from consumption of contaminated water. Landfill activities can also affect welfare needs such as loss of income from tourism activities as a result of alteration of landscape or seascape as well as general aesthetic value of the area.

Suggested Mitigation Measures

The landfill activity designed to build wharf and pier will result in permanent alteration of the physical surrounding of the Sek Lake area. The turbidity and sedimentation effects resulting in reduction of light entering water body that could affect survival of reef systems would be temporary. The approach would be to reduce the length of time of construction work. This would result in minimum time of effects of turbidity and sedimentation.

The effect of dumping on land based landfill area will be managed following several waste management regimes as follows:

- Develop and implement a waste management protocol that states that 'regular and routine check and clean-up is done around the landfill area;
- Disposal of chemical wastes will be treated and neutralized before dumping at landfill area;
- Use of adequate treatment and disposal technology.

7.1.5 Labour Importation

Activity and Environmental Consequences

Labour import will be one of the main things that the project will need to do in order to meet its schedule and project goals and objectives. People from both within PNG and abroad are expected to engage to work in various areas within the project. This project activity usually brings with it many social and economic consequences. The labour input will also have environmental implications during the construction period. Some of these by products include:

- Increase population of outside people in the area
- Sewage capacity to meet the daily demand by an increased labour population
- Accommodation or temporary accommodation for working population. Temporary accommodation may require that additional new areas be cleared.

Environmental Impacts

Improper discharge of waste by humans will affect water quality seriously through increasing biological oxygen demand that could eventually lead to eutrophication and destruction of aquatic and marine habitats which can lead to loss of species (Figure 4 above).

Human Health and Welfare Impacts

More people moving into the area could result various related socio-economic problems. Health issues that may arise may involve disease transmission such as 'sexually transmitted diseases' and HIV/AIDS infections', water borne diseases such as typhoid, cholera and dysentery, etc... Additionally, conflicts between impact area communities and workforce from outside may arise.

Sewage from workers also poses a substantial threat to water systems (rivers and creeks) within the project area. Contamination of water supplies could lead to human health problems, especially bacterially related

ones from sewage (Carpenter and Maragos, 1989) spills. This concern is important for PMIZ as the Madang Province was recently badly affected by Cholera and Dysentery, two of the worst water borne diseases.

Suggested Mitigation Measures

In order to manage environment impacts such as degradation of water quality due to increase waste discharge a few important prior arrangements will be facilitated:

- Proper housing needs to be established to house construction workers. Housing needs to be planned and established in advance before construction work begins. Temporary accommodation and associated latrines and garbage disposal systems may result in eventual contamination of coastline and lagoon area.
- A clear policy guideline on environmental requirements of the project shall be set up and all Contractors will be required to conduct induction for all their employees.
- Workplace policy on HIV/AIDS shall be endorsed by the project for all developers and contractors to use as basic guideline..

7.2 Associated Socio-economic Impacts

A number of socio-economic issues were identified that may arise as a result of the PMIZ project. A summary of impacts and related mitigation measures are described in Table 3 below. These key issues include:

- Degradation of water quality
- Law and order
- Migration and population issues
- Historical and cultural issues
- Landowners disputes
- Livelihood related issues
- Waste disposal and sewerage

The mitigation measures that will be employed by the project includes establishment of laws and regulations, workplace policies, development of agreements between impact area communities, and consider options for involvement of these communities in business spin-offs and/or other benefit sharing options. These specific mitigation approaches are:

- Monitoring of construction of the PMIZ project;
- Memorandum of Agreement or related Agreements to be developed between impact area communities and the State regarding benefit sharing aspects of the project;
- Development of Monitoring Plan to monitor other parts of Madang Lagoon is not affected.
- Ensure or develop an Agreement that recognizes that nearshore or traditional fishing grounds for the impact area communities be left alone for local and subsistence use.
- Social Mapping to be done for the area
- Awareness program on development and its implications developed and awareness conducted among impact communities as well as PMIZ employees
- Employment opportunities for youth in the area
- Conflict management training and awareness
- Relocation options to be discussed between State and Impact area communities
- Regulations on Settlements to be enacted by Provincial Government
- Proper accommodation for employees

- Workplace Policy on HIV/AIDS, other STIs and other communicable medical problems
- Anthropological studies
- Literacy Schools and Programs
- Regulation on employees involved in exchanging sex for fish
- By catch sharing arrangement to discussed and concluded
- Construction of proper sewerage facility

8. ENVIRONMENTAL MANAGEMENT, MONITORING AND REPORTING

This section of the EIS present environmental management plan (EMP). There will be several elements of the project to be developed over a period of five years and each of them will have separate EMPs based on the nature of the activity and in consistency with the preceding sections of the EIS. The EMP will provide control strategies in accordance with agreed performance criteria for specified acceptable levels of environmental harm. This EMP will therefore contain:

- Potential impacts on environmental values;
- Mitigation strategies;
- Relevant monitoring;
- Appropriate indicators and performance criteria;
- Reporting requirements; and
- Appropriate corrective actions, should an undesirable impact or unforeseen level of impact occur.

The EMP has the following objectives:

- To identify existing environmental values and socio-economic issues in the project area that requires management strategies;
- To recommend management measures for the environmental and socio-economic issues and values identified;
- To develop and implement a structured monitoring program;
- To identify roles and responsibilities for environmental management.

This EMP is done following this structure:

Element/Issue:	Aspect of construction or operation to be managed (as it affects environmental values).
Operational Policy:	The operational policy or management objective that applies to the element.
Performance Criteria:	The operational policy or management objective that applies to the element.
Performance Criteria:	Measurable performance criteria (outcomes) for each element of the operation.
Monitoring:	The monitoring requirements to measure actual performance (i.e. specified limits to pre-selected indicators of change).
Auditing:	The auditing requirements to demonstrate implementation of agreed construction and operation environmental management strategies and compliance with agreed performance criteria.
Reporting:	Format, timing and responsibility for reporting and auditing of monitoring results.

London Convention

The convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 or commonly referred to as "London Convention" seeks to protect the marine environment from human activities. The objective of this Convention is to promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter. In 1996 the "London Protocol" was developed to further modernize the Convention and eventually, replace it. Under the Protocol all dumping is prohibited except for certain listed wastes that include the following:

- Dredged material;
- Sewage sludge;
- Fish wastes;
- Inert, inorganic geological materials (e.g mining wastes);
- Organic material of natural origin; and
- Bulky items primarily comprising iron, steel and concrete.

The PMIZ project will need to comply to this international agreement.

10. CONFIDENTIAL INFORMATION

The PMIZ National Management Committee advice that there are no classified information with respect to preparation of the PMIZ EIS.

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Note: See also References and Bibliography under Appendices 2 and 3.

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During the two field trips to the project site members of Rempi and Kananam were able to spent time to sit down with the consulting team and respond to a number of pressing questions in relation to the project. Important to note, they did not hide their most sincere concerns in relation to the project.

Mr. Albert Ayius provided the much needed guidance to organize and write up the socio-economic component of this.

The BRG staff spent a good two hours pointing out issues surrounding this project in relation to environmental and socio-economic concerns.

In drafting this EIS I have tried to as much as possible input the points pointed by participating members of the communities as well as the Civil Society Organizations.

To all ... mentioned and not mentioned ... this document would not be possible without your support.... I thank you all....

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Appendix 3

Environment

Inception Report

Department of Commerce and Industry

Environment Inception Report

Pacific Marine Industrial Zone

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December 2002

TABLE OF CONTENTS

1. INTRODUCTION	1
1.1 Project name and objectives	1
1.2 Project Activity	1
1.3 Potential benefits from the project	1
1.4 Anticipated biophysical impacts	2
1.5 Anticipated socio-economic impacts	2
1.6 Project area and location	3
1.7 Project development phases and environmental requirements	3
2. PURPOSE OF THE DEVELOPMENT	3
2.1 Project Objectives	3
2.2 Is the project in the best interest of Papua New Guineans?	5
3. VIABILITY OF THE PROJECT	6
3.1 Consistency with government development priorities	6
3.2 Viability—socio-economic context	6
3.3 Viability—environmental context	7
4. DESCRIPTION OF THE PROPOSED DEVELOPMENT	7
4.1 General description of facility setup	7
5. DEVELOPMENT TIMETABLE	9
6. BIOPHYSICAL ENVIRONMENTAL ISSUES	9
6.1 Physical properties	9
Soil erosion	9
Water yield	9
Water quality	11
Climate Change	11
6.2 Biological properties	11
6.2.1 Terrestrial Flora	11
6.2.2 Terrestrial Fauna	11
6.2.3 Estuarine and marine ecosystem	12
7. SOCIO-ECONOMIC ISSUES	14
7.1 Group A: Impacts that can be addressed by DEC	14
7.2 Group B: Impacts that can be addressed by other government bodies	15
8. AVAILABILITY OF BASELINE INFORMATION	17
A. Biophysical information	17
B. Socio-economic information / data	17
9. SITE SELECTION	17
10. QUALIFICATION OF ENVIRONMENTAL CONSULTANTS	18

LIST OF FIGURES

Figure 1: Topographic Map showing locality of PMIZ Project Area, Madang Province 4
Figure 2: PMIZ Project Development Timetable..... 10

LIST OF APPENDICES

Appendix 1: Project layout plan 21
Appendix 2: Common plants recorded during the scoping trip 22
Appendix 3: Table of common fauna recorded from the project area 23
Appendix 4A & 4B: Some notable species of fishes and marine fauna recorded from Madang Lagoon 24
Appendix 5: Bibliography of information sources 29



1. INTRODUCTION

1.1 PROJECT NAME AND OBJECTIVES

The proposed development is called the *Pacific Marine Industrial Zone (or PMIZ)*. The overall objective of the project is to increase income generation opportunities for the state to be able to meet its demands and obligations to people of PNG. At local level the project aims at improving income opportunities and the general livelihood conditions of the project area communities.

1.2 THE PROJECT ACTIVITY

The project will be developed through a partnership arrangement between the State, private sector investors. The project partners are:

- (a) Madang Provincial Government (MPG)
- (b) National Fisheries Authority (NFA)
- (c) Department of Commerce and Industry (DCI)
- (d) RD Canning Ltd. (RD)
- (e) Independent Public Business Corporation (IPBC)

Other government agencies such as the Attorney General, Department of National Planning and Monitoring and the Department of Environment and Conservation.

The project activity will involve major excavation work on the current project site at Vidar Plantation area of approximately 215 hectares. The development during construction will require excavation of land area as well as shoreline area at Vidar (see Figure 1 and Appendix 1) showing the project layout plan). Construction of infrastructure will include wharf and pier, road network, accommodation facilities, storage areas, water treatment and discharge facilities and other components (see Section 4.0 and Project Development Timetable in Section 5.0).

The project activity is proposed to take approximately five years. The project will be financed in part by the Government of PNG and counterpart funding to be sourced abroad on loan basis.

1.3 POTENTIAL BENEFITS FROM THE PROJECT

The project will have significant economic and social benefits to the state as well as rural/local population within Madang Province and the immediate project site. The benefits are largely economic with social implications. Some of the most significant ones include:

- Increase in cash flow within the immediate impact area villages and the Madang Province as a whole. This increase in cash flow will have significant positive social impacts such as improvement in basic infrastructure such as road network and conditions, improve education and health facilities which can have further indirect impact of reducing illiteracy and general health conditions of people;
- At national level it is estimated to contribute national income of approximate K2 billion annually once in full operation (after year 5);
- Training and development: training of young people in technical and management aspects of fisheries projects.

1.4 ANTICIPATED BIOPHYSICAL IMPACTS

The project will have significant biophysical impacts at its initial construction and development phase. At the construction phase major excavation and land reclamation work will be done which will contribute to serious erosion related problems within the immediate project area. However, these are expected to sharply decline once construction is completed.

Ongoing impacts on environment will involve discharge of waste into the sea and/or sewerage systems, noise from the industrial activities, air pollution from factory operations, etc.. Species composition and population of marine life at the Madang Lagoon area will also be affected implying a major disruption in the ecosystem.

During construction sedimentation will affect sea grasses, reefs and mangroves. The construction activity is also expected to redirect the main local currents in the area which may affect sedimentation in the water bodies of the lagoon.

1.5 ANTICIPATED SOCIO-ECONOMIC IMPACTS

- Potential socio-economic impacts in the project have recently been subject of major debate and resentment among impact area communities.
- Potential positive impacts include:-
- Improved livelihood conditions of impact area communities;
- Improved basic services such as good road network and conditions, improved health and education facilities;
- Increased cash flow within the immediate area, Madang Province and Country as a whole;
- Positive image of the Country within the region is facilitated through this project which could affect survival of marine and estuarine life forms that are source of protein for local people;

Potential negative impacts include:-

- Decline in local supply of fish for subsistence consumption by impact area communities;
- Loss of income opportunities from tourism and other related sources currently being enjoyed by impact area communities;
- Increase in abuse of local women folk by company workers;
- Loss of traditional and cultural value areas on land (such as the lagoon) and the marine areas;
- Loss of traditional rights to land and marine resources;

Increase level of erosion into the Madang Lagoon during construction phase of the project

1.6 PROJECT AREA AND LOCATION

The PMIZ project area is located within the Vidar Plantation, approximately 20km north of Madang Town (Figure 1). The area of interest is currently registered as Portion 1349 and 1350 (Appendix 1).

The project area as indicated on Map (Figure 1) is currently Vidar Plantation of Cocoa and Coconut. The area is highly disturbed with no natural forest. Towards the west is customary land with secondary forest as a result of anthropogenic activities such as subsistence gardening and small cocoa and coconut farms by the local people.

1.7 PROJECT DEVELOPMENT PHASES AND ENVIRONMENTAL REQUIREMENTS

The PMIZ project will be implemented in three phases as follows:

- Phase 1: General project requirements: (i) feasibility studies, surveys and site investigations, architecture and engineering design, permits and insurance; (ii) excavation and land reclamation for wharf and port, construction of roads and bridges, other basic infrastructure development (roads, bridges, communication facility, water supply).
- Phase 2: Marine Industrial Zone: This will involve establishment of all installments of the Industrial Zone, includes the Locators, Container Terminal, Fuel Farm, Fish Port, Fish Market, Wharf and Pier, Commercial Complex, Staff housing and accommodation, and Administration Building. It will also include establishment of Telecommunication Facilities, Water Supply Facility, Waste Water Treatment Plant and the Power Supply Facility.
- Phase 3: Monitoring and Evaluation

At this inception phase the project is submitting for Environmental Implications and impacts for Phase 2 activities (Site Development). The Phase 3 activities will involve installments and submissions for environmental impact statements will be done as each of these installments are to be set up.

2. PURPOSE OF THE DEVELOPMENT

2.1 PROJECT OBJECTIVES

The overall objective of the project is to increase income generation opportunities for the state to be able to meet its demands and obligations to people of PNG. At local level the project aims at improving income opportunities for impact area communities as well improvement in general livelihood conditions of the people.

SOCIO-ECONOMIC OBJECTIVES

- 1.1.1 To maximize economic benefits of the marine resources especially tuna for PNG and its proposed partners/stakeholders;
- 1.1.2 To create economies of scale good enough for the locators of the proposed Marine Industrial Zone to be internationally competitive;

- 1.1.3 To establish a competitive regional common service facility for all Pacific Island Countries to consider as an investment opportunity that will serve as a major off loading center for tuna caught from within their respective fishing grounds;
- 1.1.4 To promote development of fishery and set up a linkage development of the fish industry;
- 1.1.5 To drive the fast development of manufacturer industry and provide more jobs to local people

ENVIRONMENTAL OBJECTIVES

The environmental objectives of the project are:

- To ensure compliance with all environmental regulations of the state and to monitor impacts of development activity and incorporate corrective measures throughout the life of the project

2.2 IS THE PROJECT IN THE BEST INTEREST OF PAPUA NEW GUINEANS?

The project has at its core and underlying reasoning as improvement of livelihood conditions of Papua New Guineans. The project is designed consistent with the National Constitution of PNG as enshrined in its Five National Goals and Eight Directive Principles. The project satisfies all the five national goals, especially the Fourth National Goal which declares Papua New Guineans commitment to sustainably manage their environment and natural resources and reads:

"We declare our Fourth Goal to be for Papua New Guinea natural resources and environment to be conserved and used for the collective benefit of us all, and be replenished for the benefit of future generations."

This project business product is 'fish' and other marine resources which are renewable resources if utilized in a sustainable way. The fisheries resources of the Western Pacific Region especially Tuna will be the target product. Management regime of this project will require greater level of monitoring to ensure harvesting of this resource does not exceed maximum sustainable yield or harvest. To be able to ensure this is so, requires greater level of negotiation, research and discussion among partners within PMIZ and at bilateral and multilateral level by governments of participating nations.

At local and provincial level the project has greater potential for positive socio-economic impacts. However, it requires better and open level of consultation among stakeholders including impact area communities.

The project will be contributing export earnings of approximately K2 billion which is significant contribution towards national income and will therefore benefit Papua New Guineans.

3. VIABILITY OF THE PROJECT

3.1 CONSISTENCY WITH GOVERNMENT DEVELOPMENT PRIORITIES

The project operationalises many of the requirements of the National Constitution and the National, Provincial and District Development Strategies and Policies. Among these are the Five National Goals of the National Constitution. Some important national, provincial and district development strategies and/or policies include:-

- (a) The *Medium Term Development Strategy (MTDS) 2005 – 2010*. This focuses on Economic Recovery, Growth and Development through Export-driven Economic Growth and Rural Development, Poverty Reduction and Empowerment through Human Resource Development.
- (b) The *National Agriculture Development Plan (2008 – 2016)*. This focus on achieving economic development through export driven actions. Fisheries was also captured in this plan as a significant product for development to achieve income generation through export earnings.
- (c) The *National Biodiversity Strategic Action Plan 2000* by streamlining recommendations and strategies specified in other national policies and strategies such as the MTDS 2005 - 2010, The National Agriculture and Livestock Policy 2007 - 2012, National Food Security Policy 2000 – 2010, National Health Policy 2000 – 2010, Forest Policy, Eco-Forestry Policy, Education Policy and the draft Carbon Trade Policy 2005.

Indirectly, the project will be responding to requirements of other policy requirements such as:

- (a) The *Integrated Community Development Policy, 2007* by its commitment to encourage wider stakeholder participation and involvement of rural community as well as the capacity building plans it has in place through community learning and development centres (CLDCs).
- (b) The *National Youth Policy, 2007 - 2017*, through its commitment to provide training and awareness among rural communities of whom approximately 30% are youth, who will form the bulk of the workforce in the project.

At provincial level the project responds to income generation needs of the provincial government. It is consistent with policies and strategies of National Fisheries Authority in enhancing and increasing income generation through fisheries development.

3.2 VIABILITY – SOCIO-ECONOMIC CONTEXT

The project will be socio-economically viable given its potential for income generation and facilitation of improvement of social services such as education, health and communication. Capacity building within the project will also be key component and set a basis for self-reliance in the communities involved to bring about positive change.

With development incentives of this nature negative social impacts are expected. The communities, government and civil society organizations under this project will work in partnership to address these issues. These issues are pointed out in the later section of this report. On the balance socio-economic benefits will outweigh the negative implications.

3.3 VIABILITY – ENVIRONMENTAL CONTEXT

The project will be developed according to the environmental laws of PNG and in compliance with requirements of Environment Act 2000. Important aspect of the project will be its strategies in minimizing environmental impacts in the Lagoon and surrounding area as well as operating an economically viable project at maximum sustainable yields and not exceeding these levels. Such an operation will enable sustainable business operations within the country and western pacific region.

At each development phase of the project different types of impacts are expected as a result of construction and development activity on the land and sea (physical resources). Mitigation measures will be developed at each of those stages of development.

4. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The scope of work encompasses the following components

- Construction of drainage, bridges, roads, etc...; wharf and pier facility; factory; commercial complex; cool storage; waste water treatment plant; modern facilities for communication; water supply facility; power supply and reticulation; fuel depot; fish market; administration buildings; residential complex; and;
- purchase of plant, vehicles and equipments

This level of activity will require major alteration of the land including excavation and land reclamation at beach front of the area.

4.1 GENERAL DESCRIPTION OF FACILITY SETUP

The industrial zone will be developed in four phases with the main installments as follows:

- (a) The construction of drainage, bridges, roads, etc..**
A drainage system will be constructed and will involve laying of piping leading westerly towards the seaside. The road network was designed taking into consideration adequacy, economy and safety. The main road will have right-of-way of 34m and carriageway of 30m. Secondary roads will have 24m and 20m right-of-way and carriageway respectively.
- (b) Wharf and Pier**
A pier having a total length of 1,165 linear metres or 1.165km will be constructed. Of 349.5 linear metres will be used as raised walkway over water which will be supported by widely spread piles or pillars.
- (c) Staff housing**
The construction of staff housing will provide residency to staff who are working in the zone. The houses shall be designed functionally and conveniently.

(d) **Commercial Complex**

This commercial complex will provide services and opportunities for people living within and outside PMIZ area. These benefits include: supermarket, houses, markets and business or companies. A warehouse will also be constructed as part of this complex.

(e) **Cool storage**

The refrigeration building will be constructed over an area of 8,364m² with a capacity of 10,000 metric tons of fish and meat products. It will be suitable for holding fish and fish products at temperature range 0 – 4°C. The 'cool storage' facility will have different options for cooling and preserving fish quality. These include block; flake and plate ice.

(f) **Waste Water Treatment Plant**

A waste water treatment plant is will cater for treatment and disposal of waste water and effluents from domestic and industrial activities prior to disposal into environment. The facility will cater for various types of waste materials namely, solids; oil and grease; and biodegradable materials.

An Activated sludge process and the Trickling Filter Processes are proposed to be constructed to treat waste water. Acids, alkalis and organic materials such as paints, solvents, pharmaceuticals, pesticides, cooking products, and so forth will also be treated before discharge into the environment.

(g) **Communication and utilities**

Modern communication facility will be constructed to provide needs for the industrial centre. Important utilities such as power and water will also be established within the PMIZ. The water supply system will have a water storage area after treatment from raw water from source. The Power system will have initial capacity of 1MVA with potential for increase.

(h) **Fuel depot**

Fuel depot will occupy a total area of 3 ha. This will be for the purpose of storage and supply of gas and petrochemical products to users within the Industrial Zone or outside customers. Two main components will be the fuel tanks and the fire station. The fuel tanks will have capacity for 2 million Litres per tank.

(i) **Administration buildings**

The administration building will occupy 720m² area and will provide for the management team to oversee the industrial area.

(j) **The Residential Complex**

The residential complex work will involve site preparation works, roads, electricity, water supply, and other necessary utilities.

(k) **Container Freight Station and Terminal**

The container terminal will occupy an area of 8 ha and will cater for transshipment of cargo containers from one form of vehicle to the other or from trucks to trucks or from ships to trucks and vice versa. A truck and trailer holding area (Container Freight Station) that covers 13,650m² will also be developed.

(l) **Fish Port and Canary**

The Fish Port will cover an area of 8 ha and will be constructed at a total cost of US\$ 50,018,741 (K166,729,136). This is expected to service a huge Tuna based fishing fleet

off Madang with an estimated unloading rate of 200 metric tons per day. The site is partially under water and needs to be developed through clearing of debris and dredging for reclamation and foundation construction.

(m) Landfill

A landfill area will be established approximately 5km from the project site. This will be used for disposal of waste materials from the operations of the Industrial Zone. This can also be used to reclaim land that is not suitable for development purposes.

(n) Purchase of materials and plant

Materials and plant will be obtained following the policy of the financier, China Exim Bank in which 30% of materials and equipment will be obtained locally while 70% is to be obtained from China.

The project will be undertaken in four phases from project inception to actual production and marketing.

5. DEVELOPMENT TIMETABLE

The Project is expected to be developed over a period of five years as indicated in Figure 2 attached below. The Environment Impact Statement is expected to be completed and submitted by end of December 2009. The Environment Permit application is expected to be done by February 2010.

6. BIO-PHYSICAL ENVIRONMENTAL ISSUES

Several biophysical environmental issues are expected from the development project of the magnitude of the PMIZ project. Most significant of which is wholesale alteration of the physical environment.

6.1 PHYSICAL PROPERTIES

SOIL EROSION

The main environmental issues will be soil erosion during the construction activity in the land preparation phase of the project. This erosion activity will be result of exposed and disturbed soil. Erosion will lead to increased sedimentation within the lagoon and this is detrimental to reefs, mangroves and sea-grasses which are home a variety of sedentary species supporting the lower trophic level of the ecosystem.

Death of reefs, mangroves and sea grasses will have detrimental chain reaction on upper trophic level of the ecosystem. These impacts can be mitigated with good planning and implementation of project activities. The mangrove forests along the Madang Lagoon area will be badly affected as will be the reef systems.

Wind erosion can occur although not expected to be significant within the PMIZ area as the Madang area experiences wet periods all year round generally. However, with the current varying climatic regime and the *el nino* effects, droughts are more and more likely to happen. In such an event whole sale clearance will lead to greater wind erosion levels.

Figure 2: Project Development Timetable

Refer to Page 19 of this EIS



WATER YIELD

Clearing of the existing plantation and the underbrush is expected to increase water yield as the capacity of the trees and plants in collecting water will have been removed. Although the area is plantation area, it had been like this for over 100 years and the ecosystem would be stabilized according to the disturbance (plantation). Wholesale clearing will significantly increase run-off which will subsequently increase erosion and sedimentation significantly. The clearance is permanent but the exposure would be temporary. Erosion rates should drop as the soil is covered by concrete.

WATER QUALITY

Land clearing and subsequent soil disturbance are known to increase sedimentation in creeks, rivers and lakes together with leaching of nutrients from disturbed top soil. This has potential of affecting water quality parameters such as pH, dissolved oxygen, turbidity, major ions, nutrient ions and temperature.

Fine particles from road construction, fencing, wharf construction, accommodation facilities, etc. will be main source of sedimentation while main sources of nutrients will be from decaying organic matter from cleared vegetation and exposed topsoil.

Waste water from the residential areas and the factories plus the nearby villages will also contribute significantly towards affecting water quality in the later part of the project. The waste materials will be a consistent discharge throughout the life of the project and will be the most significant factor that will influence the quality of water. Sedimentation and nutrient level entering streams and rivers are expected to decline as the soil is compact and sealed.

CLIMATE CHANGE AND RELATED IMPLICATIONS

The current worldwide concern on climate change and its related implications are real and is likely to have significant environmental as well as socio-economic impacts on the project. Climate change factor has potential of cause variation in temperatures of main water bodies and currents within the western pacific. This variation in water temperatures can lead to migration of tuna stock within the western pacific waters. This can lead to reduction in catch which can affect profitability of the project. This factor however is outside the direct influence of the PMIZ project.

6.2 BIOLOGICAL PROPERTIES

The project area has undergone human activity for over 50 years beginning with the settlement of missionaries which led to establishment of Vidar Plantation (Cocoa and Coconut) and the Alexishafen mission station. The marine ecosystem is quite intact, while the terrestrial ecosystem had been transformed considerably.

6.2.1 TERRESTRIAL FLORA

Floristically, the forest is disturbed such that there is **no natural forest**. It has been converted to plantation forest of Coconut and Cocoa. Appendix 2 shows the list of common plants noted during the initial scoping of the area. Socio-economically important species include Pandanus, Sago Palms and Trees such as the Kwila which are used by local people as food source and for construction of houses. **As the project involves wholesale clearance and excavation all these floral species will be removed.** There will be no impact on natural flora as the area is disturbed.

Environment Inception Report / 2009

(D) FISHES

Fishes are found anywhere in the sea, freshwater and the estuarine waters. At the project site some important fishes were recorded. Two endemic resident reef fish species identified were Black stripe blenny (*Meiacanthus vittatus*) and the Whitespot damselfish (*Pomacentrus albimaculatus*); at least two globally endangered fishes, the Humphead wrasse (*Cheilinus undulatus*) and the Giant Queensland Crouper (*Epinephalus lanceolatus*); endangered whale sharks (*Rhincodon typus*) have been seen in the area as well.

These endangered and endemic species of fishes will be affected when the construction begin. Throughout the life of the project as major vessels use the harbour and the area these fishes are expected to migrate and will cease as their habitats are destroyed.

(E) CORALS

The Madang Lagoon area is major part of the coral triangle region. The survey and previous studies confirm that this area is possibly the epicenter of coral diversity. Estimates of coral species diversity are as high as 700 species (comparatively higher than Great Barrier Reefs). The coral identified are both soft and hard corals. Branching *Acropora* and large *Porites* coral heads are most common in more stable areas. The steeper drop offs contain large tabulate *Acropora*, *Montipora* and *Anacropora*. Soft corals are well represented covering approximately 12% of the area. Sarcophyton is most common but other genera such as *Sinularia*, *Tubipora*, *Briarium*, *Zenia* and *Lemnalia* can be found in abundance.

These coral system in Madang Lagoon makes it one of the most significant ecosystems within PNG and Coral Triangle Region. The development activity is likely to significantly alter this coral reef ecosystem. Corals form the important feeding ground, shelter and breeding ground for many fish and marine life forms.

(F) ECHINODERMS

A variety of species of echinoderms are found at the project site such as the sea stars and feather stars. Important economic species found include several species of Holothurians (sea cucumbers). These include *Bohadschia argus*, *Bohadschia graeffei*, *Thelenota anax*, *T. ananas*, *Holothuria fuscopunctata*, *H. edulis* and *Stichopus variegatus*. These were noted to be low in numbers possibly because they were harvested unsustainably to be sold to Asian buyers in Madang.

(G) MOLLUSCS

Two species of CITES-listed Giant clams (*Tridacna croacea* and *T. derasa*) were sighted, however, these are in low numbers. Other species sighted include: Cephalopods such as the reef cuttlefish (*Sepia latimanus*), Bigfin reef squid (*Sepioteuthis lessoniana*) and Common reef octopus (*Octopus cyanea*).

These mollusks species are important source of protein for the local people and also dependent on sea grass, sea weed and reef ecosystem. Destruction of these different habitats will significantly affect the mollusks population. Additionally, pollution from chemicals and waste discharge will significantly affect these taxa as these are mostly filter feeders.

(H) CRUSTACEANS

Previous studies indicate that approximately 180 species of gammaridean amphipoda exist in the Madang Lagoon area. Some common species noted include: Painted rock lobster (*Panulirus ver-*

sicolor) existing in only low numbers; Banded Cleaner Shrimp (*Stenopus hispidus*) is relatively common in deeper waters; Manthis Shrimp (*Odontodactylus scyllarus*), snapping shrimps (Alpheidae), cleaner shrimps and symbiotic shrimps (Hyppolytidae), boxer shrimps, hermit crabs (Diogenidae), shore crabs (Grapsidae) and sponge crabs (Dromidae).

Crustaceans are also main group of filter feeders and very susceptible to change in water quality, dissolved materials, including sediments, chemicals and other products. They also form an important food source for local people.

(I) REPTILES

Two species of globally endangered species of turtles were sighted in the project area. These are the Hawksbill (*Eretmochelys imbricata*) and Green Turtle (*Chelonia mydas*). The banded sea snakes (*Laticauda colubrina*) were also sighted in abundance.

(J) MARINE MAMMALS

The lagoon is also home to three different endangered marine mammal species: Dugongs, Spinner dolphins (*Stenella longirostris*), Bridled dolphins (*S. attenuata*) and the Pacific Pilot Whale (*Globicephala macrorhynchus*).

7. SOCIO-ECONOMIC ISSUES

GROUP (A): IMPACTS THAT CAN BE ADDRESSED BY DEC

(A) DEGRADATION IN AIR AND WATER QUALITY

DEGRADATION OF AIR QUALITY

At the construction phase of the project, there will be little to no significant impact on the change in quality of air. However, in the actual production stage air quality issues will form the major component of the environmental compliance as is currently experienced through the operations of RD Tuna Canning Ltd.

DEGRADATION OF WATER QUALITY

The freshwater lake within the project area is a sacred site for the local people within the impact area, especially Rempu and Kananam Villages. Operations of the project if not done with diligence are like to alter the quality of water. Land clearance and continue development actions indicate that its sacred values are eroding. Construction work near the lake for fencing may lead to sedimentation as a result of erosion during rains.

The mangrove and marine waters within the lagoon when polluted with sediments and various heavy metals and organic products from factory and accommodation will not be able to support the wide variety of natural products that support the livelihood of local communities in the area. River systems will not be significantly affected by the project as it is based along the coast.

(B) LAND, SEA AND FRESH WATER CONTAMINATION

The construction phase of the project will not have significant contamination effects as much of it will be excavation and general clearance. Oil spills from vehicles and heavy equipment will be significant less and be insignificant. However, experiences of communities indicate that certain oil spills had led to several children being seriously ill and admitted to General Hospital in Madang.

Contamination can be from disposal of dead fish or fish parts into the sea, land or river systems near the project area. This dead fish and marine products can be through deliberate dumping or accidental during transfer of fish and marine products from vessels to landing site. Several observations indicate that many dead fish were seen floating at the harbour site. This could be dangerous as sharks can be attracted by smell of blood due to such accidental or careless actions.

The operational phase of the project involving treatment of fish and marine products, ice production, disposal of fish parts and various other activities will eventually lead to some level of contamination. This will be addressed at the time of establishment of each of components of the PMIZ project.

Actions need to be taken to address the issue of waste disposal and handling of fish and other marine products near the harbour and local fishing grounds.

(C) LOSS OF FOOD SOURCES

Main food sources that will be affected are the marine products and fish that local people largely depend on. People will be expected to depend more and more on cash economy to meet their basic protein and energy needs daily. Current experience indicate that with operations of one fish canary people are beginning to find it difficult to fish closer to their homes and villages.

This will significantly increase with increased number of factories and commercial activity in the area. Reduction in quality of water and subsequent depletion of lower trophic level organisms will lead to affecting upper trophic levels which form large part of coastal people's food sources.

(D) LOSS OF HABITAT

The Madang Lagoons, iconic status as one of PNGs and Western Pacific's significant reef and marine ecosystems will be affected. Loss of this will lead to loss of other economic sources such as from tourism, from harvest and sale be-ke-de-mere and various other products.

GROUP (B): IMPACTS THAT OTHER GOVERNMENT AGENCIES CAN ADDRESS

(A) SOCIAL STRUCTURE

The impact area communities have been exposed to outside influence for over 100 years beginning with the Missionaries. Although the communities continue to maintain their traditional and cultural practices, values and norms, these are threatened by new influences.

Clan groups from the basic unit in which communities organize to discuss issues of land and resource use. Within each of the impact area villages there exist several different clans (which is subject or a detailed study) which also form the basic unit for landownership. Clan leadership is hereditary with oldest son inheriting rights and chieftaincy of each clan.

The two Landowner Companies the, Rehaamp Investment Ltd and Kananam Development Corporation are formed with basic membership from clan groups. These structure needs to be understood by the development partners to be able effectively engage local involvement in the project.

(B) LAW AND ORDER

As is likely to happen, increased law and order issues are usually and always has been a negative by product of development activities. The challenge for PMIZ will be towards identifying mechanisms that can be used to minimize these issues.

(C) MIGRATION AND POPULATION ISSUES

Population increase and migration issues are two significant and related social issues that are inevitable. Population will increase in that such a development activity will result in survival of more infants into adulthood. Migration issues will involve influx of people from other provinces and countries. In this case more Philipinos are expected as is being practiced by RD Tuna. People pointed out several related issues as follows: poor and/or improved government services, new diseases that may not be treated easily, crime, prostitution and related issues such as sexually transmitted diseases and HIV/AIDS, encroachment into customary land, alienation of more customary land, increase in disputes that cannot be resolved using traditional or community based means, increase in squatter settlements.

(D) HISTORICAL AND CULTURAL ISSUES

With greater influence from outside and increased number of formally educated young people there is greater chance of people loosing their important values and customary practices that identify them as unique people within the province and state. There are issues of protection of sacred sites that the communities must work together to address, issues of oral history that needs to be recorded, and other related matters.

Loss of these important aspects of society, would lead to people without identity and these could have other longer term implications such as land disputes and being unable to reach consensus in addressing these issues.

(E) LANDOWNERSHIP – QUESTIONABLE STATE OWNERSHIP OF LAND

Consultation with members of the local community indicated that there will be issues related to Landownership. The project will be established on what is currently state land, Portions 1349 and 1350. However, members of the impact area communities still believe that the state and the Catholic Church have cheated them. This issue may be latent or is currently at low intensity. Experience from other projects in the country indicates that such an issue needs to be addressed immediately and resolved. If not addressed effectively, it can lead to future major civil disorder and/or uprising. Demands indicated that the issues is possibly related to 'no involvement and consultation with local people after the expiry of the 99 year lease arrangement and means of compensation for the acquisition of the land by the Church and the State.

(F) LIVELIHOOD RELATED ISSUES

Livelihood related issues pointed out by the community include; loss of main fishing grounds, food security, cultural practices, values and norms; fishing practices of local people, prostitution or women involved in sex for exchange of fish.

Based on current experience with RD Tuna operations, there is concern that social issues related to loss of fishing grounds and related practices will increase further. People expressed that women will become more susceptible to abuse by men and can be involved in prostitution. Food security issues will lead to women getting involved in exchanging sex for food such as fish or cash.

Mitigation measures will need to be involved with will need to be holistic involving all aspects of development planning. It should involve capacity building actions, participation in business spin-offs, education and health and other infrastructure development activities.

8. AVAILABILITY OF BASELINE INFORMATION/DATA

The baseline data and information available and used in preparation of this document were from studies and rapid assessment surveys conducted by the Kiakapan Consulting Services in December 2009 and other literary sources as shown in Appendix 5 (Bibliography).

(A) BIO-PHYSICAL INFORMATION/DATA

- (i) Pacific Marine Industrial Zone Revise Feasibility Study, China Railway Engineering Construction Co., Ltd, July 2009.
- (ii) PNGRIS Database (Obtained from NARI)
- (iii) Topographic Maps (1:100,000), Sheet Nos. 7489 (Ambunti) and 7490 (Drekikir)
- (iv) Saunders, J.C. (1993). Forest resources of Papua New Guinea: [Map with explanatory notes]. Scale 1:100,000. PNGRIS Publication No.2. (AIDAB: Canberra.) 4 sheets & 18 p.
- (v) Kiakapan Consulting Services. 2009. Madang Lagoon Marine Survey Report, December 2009. Unpublished Report.
- (vi) Kiakapan Consulting Services. 2009. Terrestrial ecosystems rapid assessment report, December 2009. Unpublished Report
- (v) Kiakapan Consulting Services. 2009. Socio-economic rapid assessment report, December 2009. Unpublished Report.

(B) SOCIO-ECONOMIC INFORMATION/DATA

- (i) Socio-economic rapid assessment survey report, December 2009, Kiakapan Consulting Services.

9. SITE SELECTION

The PMIZ project is proposed to locate at Madang due to the following reasons:

- availability of land: the land is currently state land thus minimizing landownership issues;
- Madang provides and is located within the close proximity to the fishing grounds
- Current operations of RD Tuna Canning Ltd is located at Vidar and this project will basically be extension of the same operation

10. QUALIFICATION OF ENVIRONMENTAL CONSULTANTS

Kiakapan Consulting Services has the following team of specialists who will be involved in environment impact assessment.

No.	Name	Specialty	Designation
1	John B. SENGO	Biologists (Terrestrial Ecologist) / Environment Science	Principal
2	Job OPU	Marine Ecologist, water quality tests and analysis	Consultant
3	Paulus KULMOI	Terrestrial Ecologist	Consultant
5	Jones HIASO	Mammologist / Herpetologist	Consultant
6	Pius PISKAUT	Botanist / Vegetation Ecologist	Consultant
7	Regina PIAM	Socio-economic / Community Development Specialist	Consultant
8	Sabi PATI	Socio-economic / Community Development Specialist	Consultant
9	Gabriel KUNA	Geologist	Consultant

The resumes of each of these Specialists can be made available on request.

Brief background on each of the consultants is as follows:-

7.1. John B. SENGO – Principal Consultant

John Bruno Sengo (Mr. Sengo), is currently a private Consultant and Principal of Kiakapan Consulting Services, based in Port Moresby, NCD. Mr. Sengo was formerly the Executive Director of Conservation Melanesia (2005 – 2007). Prior to joining Conservation Melanesia he was with Village Development Trust Inc. (VDT) as Integrated Conservation and Development Project Manager for Kamiali Wildlife Management Association and later as Senior Scientific Officer.

Mr. Sengo is a person of medium built, with Melanesian features, of 161 cm height, 42 years old male and of East Sepik Parentage. However, Mr. Sengo grew up and was educated in West New Britain.

Mr. Sengo holds a Bachelor of Science Degree in Biology from the University of Papua New Guinea (UPNG) having graduated in 1993. After graduating, Mr. Sengo served as Technical Officer assisting various academic staff at the Natural Sciences Resource Centre at UPNG and later was involved in taking undergraduate tutorials and practical classes.

In 1994 June, Mr. Sengo was hired as first Field Project Manager for the Lakekamu Basin Integrated Conservation and Development Project, a project administered by Conservation International in partnership with Foundation for Peoples of the South Pacific and Wau Ecology Institute. His task then was to do liaison with the communities there. Mr. Sengo's tasks were difficult and very challenging as a young inexperienced officer. These challenges provided an opportunity for greater learning in working among rural communities. In 1999 Mr. Sengo joined Village Development Trust Inc. (VDT) for a period of slightly over five years, as Project Manager for Kamiali Wildlife Management Area Integrated Conservation and Development Project. In this job Mr. Sengo

worked with communities to plan, design and implement community conservation and development projects. Implementing community projects require dealing with people with greater diligence.

Mr. Sengo then joined Conservation Melanesia Inc. (CM) as Executive Director in 2005 and held that position until 2008 when he resigned to undertake his own consultancy practice. Mr. Sengo is now The Principal of the Kiakapan Consulting Services.

In total Mr. Sengo had been in the conservation and development arena for over 10 years. He had gained wide experiences, been involved in many conservation and development meetings, conferences, and discussion forums. Mr. Sengos contribution to conservation and development in PNG is quite significant.

Mr. Sengo is completely computer literate, fluent in English both spoken and written. Mr. Sengo had dedicated his life and career to striving to conserve and sustainable utilize the natural environment in his part of the world as a contribution to global effort in sustaining the ever important life support system (ecological processes, ecosystems).

Mr. Sengos other areas of competency include, strategic planning, project monitoring and evaluation, biodiversity surveys and assessments, environmental impact assessments, computing and windows software applications.

7.2 Job OPU – Marine Ecologist

Mr. Vagi REI is a marine ecologist, who currently holds a Diploma in Fisheries Biology and has over 15 years experience in marine ecological surveys and studies throughout PNG. He is also a certified diver and has done many dives throughout PNG. Mr. Rei has served as Principal Marine Scientist with Department of Environment since 1995. Mr. Rei was also involved in the extensive marine ecosystem and studies of the entire Madang Lagoon area in 1996 and is familiar with the area. His knowledge of the marine ecosystem of Madang Lagoon will be an added advantage for the Kiakapan Consulting Services in assessing the changes over the last 10 years and predict the impacts of new development actions in the area.

7.3 Jones HIASO – Mammals Specialist / Herpetologist

Mr. Jones Hiaso currently holds a Masters Degree in Biological Science from UPNG and is currently lecturing at the University of Goroka. Mr. Hiaso is among one of the few Papua New Guinean Herpetologist that is actively conduct research. Mr. Hiaso has conducted several rapid biodiversity assessments for Oil Search for their drilling projects within their project sites in the Highlands of PNG. Mr. Hiaso will provide to KCS this in-depth knowledge on mammals, reptiles and amphibians within the project site. He highly skilled in computing and analytical software packages and will provide this knowledge in analysis of the data obtained from the EIA of PMIZ.

7.4 Pius PISKAUT – Botanist / Vegetation Ecologist

Mr. Pius Piskaut is among one of PNGs most knowledgeable Botanist and ecologist in PNG. His special skill is in his ability to identify plants on site to genus and species level. He currently holds a Masters Degree in Botanical Sciences from Victoria University in New Zealand and is a Lecturer at the School of Natural and Physical Sciences at UPNG. Mr. Piskaut will be responsible for botanical studies within the PMIZ area. He has also conducted several studies on Mangrove ecosystems of the Madang Lagoon area in 2002 under the sponsorship of WWF/PNG. Mr. Piskaut is also a skilled and trained ecological statistician and will provide this knowledge in assisting with the analysis of the data obtained from the EIA.

7.5 Gabriel KUNA - Geologist

Mr. Gabriel KUNA is a geologist currently undertaken his own work as private consultant. Mr. Kuna will be responsible for capturing and advising the study team on geological and physical aspects of the PMIZ project area. Mr. Kuna has held several senior management posts with Department of Mining and Petroleum. His last employment was with Mineral Resource Authority as Manager – Geotech Division.

7.6 Regina PIAM – Community Development Specialist

Ms. Piam is currently the Development Coordinator for Southern and New Guinea Islands Region of the PNG Democratic Governance Program Transition Phase (formerly known as Community Development Scheme). Ms Piam holds a Diploma in PNG Studies from the Divine Word University in Madang. Ms. Piam has served as senior program officer under several main NGOs within PNG and was responsible for pilot initiative in conducting surveys for HIV/AIDS risk areas within NCD. She had also served as a senior programs officer with YWCA for over five years and thus has experience working with communities in PNG.

Ms. Piam is also a skilled facilitator in project planning designing, project monitoring and evaluation, project scoping, management and project implementation among rural communities in PNG. In her job she'd been responsible for conducting socio-economic surveys for project communities for the purpose of assessing their qualification for funding under the PNG DGTP program. Involvement of Ms. Piam in the study team will be advantageous as she is well known and regarded among the NGO community as well as community based organizations.

7.7 Mr. Sabi PATI – Community Development Specialist

Mr. Sabi Pati is community development specialist equality extensive community based experience. Academically, Mr. Pati holds a Diploma of Science in Agriculture from the Vudal Agriculture College (currently named Vudal University of Environment and Natural Resources). Mr. Pati also hold extensive experience working with various NGOs in PNG. His previous employment was as Programs Manager for Environmental Law Centre. He is currently the Assistance Development Coordinator under Ms. Piam at the PNG DGTP.

Mr. Pati is also a skilled facilitator of workshops, meetings, strategic planning workshops, monitoring and evaluation and community based project planning. In his current position like Ms. Piam, Mr. Pati had been responsible for conducting numerous socio-economic studies and surveys for the purpose of providing baseline information for projects to be funded by the PNG DGTP. Mr. Pati is also well regarded within the NGO community and his involvement in the survey team for PMIZ will be advantageous.

The above specialists / consultants will form the core of the Environment Impact Assessment Team for the PMIZ Project.

Appendix 1: Site Layout Plan of Pacific Marine Industrial Zone

*Refer to Appendix 2: Notification for Level 2 and Level 3 Project,
Annex 4 on Page 25*

Appendix 2: Flora recorded from Vidar Plantation Area, site of the PMIZ Project

No.	Common Name	Scientific Name	Status	Habitat
1		<i>Anthocephalus chinensis</i>	Common	Secondary Vegetation
2	Beach Hibiscus	<i>Hibiscus spp</i>	Common	Littoral Forest
3	Pandanus	<i>Pandanus spp</i>	Common	Littoral Forest
4		<i>Calophyllum spp</i>	Common	Littoral Forest
5		<i>Macaranga spp</i>	Common	Secondary Vegetation
6		<i>Ficus spp</i>	Common	Secondary Vegetation
7	Beach Pau	<i>Barringtonia asiatica</i>	Common	Littoral Forest
8	Pau	<i>Barringtonia spp</i>	Common	Secondary Vegetation
9	Kwila	<i>Intsia bijuga</i>	Common	Secondary Vegetation
10		<i>Syzigium spp</i>	Common	Secondary Vegetation
11	Sago	<i>Metroxylon sagu</i>	Common	Swamp
12	Coconut	<i>Cocos nucifera</i>	Common	Plantation
13	Cocoa	<i>Cocoa spp</i>	Common	Plantation

Appendix 3: Fauna recorded from Vidar Plantation Area

No.	Common Name	Scientific Name	Status	Habitat / Site Recorded
1	Torresian crow	<i>Corvus orru</i>	Common	Secondary Vegetation
2	Helmeted Friar Bird	<i>Philemon jugularis</i>	Common	Secondary Vegetation
3	Sun bird	<i>Nectarina jugularis</i>	Common	Secondary Vegetation
4	Singing Starling	<i>Aplonis canteroides</i>	Common	Secondary Vegetation
5	Rainbow Lorikeet	<i>Trichyglossus haematoides</i>	Common, CITES II	Plantation
6	Eclectus Parrot	<i>Eclectus roratus</i>	Common, CITES II	Secondary Vegetation
7	Black Kite	<i>Milvus migrans</i>	Common	Secondary Vegetation
8	Brahminy Kite	<i>Haliastur Indus</i>	Common	Secondary Vegetation
9	Wondering Duck	<i>Dendrocygna arcuata</i>	Common	Lagoon
10	Intermediate Egret	<i>Egretta intermedia</i>	Protected	Lagoon
11	Sand Piper	<i>Tringa spp</i>	Common	Lagoon
12	Freshwater Crocodile	<i>Crocodylus novaeguinea</i>	CITES II	Lagoon
13	Skink	<i>Emoia spp</i>	Common	Secondary Vegetation
14	Lizards	<i>Varanus indicus</i>	CITES II	Lagoon
15	Geckos	<i>Cyrtodactylus spp</i>	Common	Plantation
16	Death Adder	<i>Acanthopis antarcticus</i>	Common	Plantation
17	Green Tree Python	<i>Morelia viridis</i>	Common	Secondary Vegetation
18	Frogs	<i>Rana spp</i>	Common	Secondary Vegetation
19	Frogs	<i>Platymensis spp</i>	Common	Secondary Vegetation
20	Frogs	<i>Littoria spp</i>	Common	Secondary Vegetation
21	Brown Cuco-dove	<i>Macropygia amboinensis</i>	Common	Secondary Vegetation
22	Ground Dove	<i>Chalcophaps spp</i>	Common	Secondary Vegetation
23	Common Swiftlets	<i>Collocalia esculenta</i>	Common	Open

Appendix 4A: Common marine fauna around Madang Area

Soft Coral

Sarcophyton sp.
Lobophyton sp.
Sinularia sp.
Xenia sp.
Nepthea sp.
Efflatournaria sp.
Anthelia sp.

Hard Coral

Seriatophora histrix
Montipora sp.
Montipora danae
Anacropora puertogalerae
Acropora hyacinthus
Acropora humilis
Acropora monticulosa
Acropora grandis
Acropora loris
Acropora palifera
Acropora rubusta
Acropora cerealis
Acropora formosa
Stylophora pistillata
Goniopora sp.
Pavona explanulata
Pachyseris sp.
Porites sp.
Pocillapora verrucosa
Fungia sp.
Oulophyllia crista
Oulophyllia benettae
Platygyra sp.
Euphyllia ancora
Euphyllia sp.
Goniopora sp.
Diploastrea heliopora
Favites sp.
Symphillia sp.
Hydnophora sp.
Plerogyra sp.

Sea Snakes

Laticauda sp.

Green Algae

Sea grape- *Caulerpa racemosa*
Halimeda maculosa
Halimeda micronésica
Halimeda opuntia
Velonia Ventricosa

Marine Worms

Spirobranchus giganteus

Giant Clams

Tridacna sp.

Sea Stars

Linckia sp.
Choriaster grannulatus

Tunicates

Didemnum molle
Lissoclinum patella
Rhopalea crassa

Sponges

Gelliodes fibullatus
Stylotella aurantium
Cribrorchalina sp.

Sea Cucumber

Bohadschia argus
Bohadschia graeffei
Thelenota anax
Thelenota ananas
Holothuria fuscopunctata
Holothuria edulis
Stichopus variegatus

Anemones

Stichodactyla gigantea
Stichodactyla mertensii

Crinoids

Colobometra perspinosa
Tropiometra apra
Oxycomanthus bennetti
Himerometra bartschi
Comanthina

Appendix 4B: Common Reef Fishes Around Madang

Pomacentridae

Pomacentrus

adelus
burroughi
amboinensis
bankanensis
brachialis
coelestis
lepidogenys
moluccensis
nagasakiensis
nigromanus
reidi
simsiang
smithi
vaiuli

Chrysiptera

oxycephala
parasema
rex
rollandi
talboti
unimaculata

Chromis

amboinensis
atripectoralis
atripes
lepidolepis
lineata
margaritifer
retrofasciata
ternatensis
viridis
xanthochira
xanthura
Weberi

Dischistodus

prosopotania
melanotus

Ablyglyphidodon

aureus
curacao
leucogaster
ternatensis

Neoglyphidodon

melas
nigrorus

Plectroglyphido-
don

dickii
lacrymatus

Hemiglyphidodon

plagiometopom

Dascyllus

aruanus
melanurus
reticulatus
trimaculatus

Amphiprion

chrysopterus
clarckii
melanopus
percula
perideraion
sandracinus

Premnas

biaculeatus

Acanthochromis

polyacanthus

Abudefduf

vaigiensis

Chelioprion

labiatus

Labridae

Thalassoma

hardwicke
janseni
lunare
purpureum
amblycephalum

Cheilinus

celebicus
chlororus
diagrammus
fasciatus
orientalis
trilobatus
undulatus
unilineatus

Chaetodon

ocellicaudis

octofaciatus
ornatissimus
oxycephala
pelewensis
rafflesi

Appendix 4B: Common Reef Fishes Around Madang continue....

<i>Chaetodon</i>	<i>semion</i> <i>speculum</i> <i>trifascialis</i> <i>trifasciatus</i> <i>ulietensis</i> <i>unimaculatus</i> <i>vagabundus</i>	Nemipteridae <i>Scolopsis</i>	<i>bilineatus</i> <i>ciliaris</i> <i>lineatus</i> <i>margaritifer</i> <i>trilineatus</i>
<i>Heniochus</i>	<i>chrysostomous</i> <i>singularis</i> <i>varius</i> <i>acuminatus</i>	<i>Pentapodus</i>	<i>trivittatus</i> sp
<i>Forcipiger</i>	<i>flavissimus</i> <i>longirostris</i>	Belonidae <i>Tylosorourus</i>	<i>crocodilus</i>
<i>Parachaetodon</i>	<i>ocellatus</i>	Scaridae <i>Bolbometopom</i>	<i>muricatum</i>
Pomacanthidae <i>Pomacanthus</i>	<i>sexstriatus</i> <i>xanthometopom</i>	<i>scarus</i>	<i>bleekeri</i> <i>bowseri</i> <i>chameleon</i> <i>dimidiatus</i> <i>fem and juvs</i> <i>flavipectoralis</i> <i>forsteni</i> <i>frenatus</i> <i>ghobban</i> <i>microrhinos</i> <i>niger</i> <i>phyrrhurus</i> <i>qouoyi</i> <i>rivulatus</i> <i>shlegeli</i> <i>sordidus</i> <i>spinus</i>
<i>Pygoplites</i>	<i>diacanthus</i>		
<i>Centropyge</i>	<i>bicolor</i> <i>bispinosus</i> <i>nox</i> <i>vroliki</i>		
<i>Chaetodontoplus</i>	<i>mesoleucas</i>		
Serranidae <i>Pseudanthias</i>	<i>tuka</i> <i>hutchii</i>	<i>Cetoscarus</i>	<i>bicolor</i>
<i>Cephalopholis</i>	<i>cyanostigma</i> <i>ongus</i> <i>urodeta</i>	<i>Calotomus</i>	<i>carolinus</i>
<i>Epinephalus</i>	<i>fasciatus</i> <i>merra</i> <i>maculatus</i>	Siganidae <i>Siganus</i>	<i>corallinus</i>
<i>Anyperodon</i>	<i>leucogrammicus</i>	<i>Siganus</i>	<i>doliatus</i> <i>lineatus</i> <i>puellus</i> <i>punctatissimus</i> <i>virgatus</i> <i>vulpinus</i>
<i>Plectropomus</i>	<i>leavis</i> <i>leopardus</i>		
Zanclidae <i>Zanclus</i>	<i>cornutus</i>	Apogonidae <i>Apogon</i>	<i>angustatus</i> <i>compressus</i> <i>cyanosoma</i> <i>frenatus</i>

Appendix 4B: Common Reef Fishes Around Madang continue....

Apogonidae			
Apogon	<i>fuscus</i>	Lethrinidae	
	<i>leptacanthus</i>	<i>Monotaxis</i>	
	<i>quinquelineatus</i>		<i>grandoculis</i>
<i>Cheilodipterus</i>		<i>Lethrinis</i>	<i>erythropterus</i>
	<i>macrodon</i>		<i>nebulosus</i>
	<i>quinquelineatus</i>	<i>Gnathodentex</i>	<i>aurolineatus</i>
	<i>zonata</i>		
<i>Archamia</i>		Mullidae	
	<i>zosterophora</i>	<i>Parupeneus</i>	<i>barabarinus</i>
	<i>biguttata</i>		<i>barbarinoides</i>
	<i>sp.</i>		<i>bifasciatus</i>
Balistidae			<i>cyclostomacous</i>
<i>Balistapus</i>	<i>undulatus</i>		<i>heptacanthus</i>
<i>Rhineacanthus</i>			<i>multifasciatus</i>
	<i>aculeatus</i>	<i>Mulloides</i>	
<i>sufflamen</i>			<i>flavolineatus</i>
	<i>bursa</i>	<i>Upeneus</i>	
	<i>chrysopterus</i>		<i>tragula</i>
<i>Balistoides</i>		Tetraodontidae	
	<i>viridescens</i>	<i>Arothron</i>	<i>mappa</i>
<i>Pseudobalistes</i>			<i>nigropunctatus</i>
	<i>undulatus</i>	<i>Canthigaster</i>	
<i>Paraluteres</i>			<i>solandri</i>
	<i>prionurus</i>		<i>valentini</i>
Lutjanidae			<i>amboinensis</i>
<i>Lutjanus</i>	<i>biguttatus</i>	Ostraciidae	
	<i>bohar</i>	<i>Ostracion</i>	<i>cubicus</i>
	<i>carponotatus</i>		<i>meleagris</i>
	<i>ehrenbergi</i>		<i>solarensis</i>
	<i>gibbus</i>		
	<i>kasmira</i>	Pinguipedidae	
	<i>rivulatus</i>	<i>Parapercis</i>	<i>clathrata</i>
	<i>semicinctus</i>		
<i>Macolor</i>		Caesionidae	
	<i>niger</i>	<i>Pteroceasio</i>	<i>iatovittata</i>
	<i>macularis</i>		<i>pisang</i>
Ephippidae			<i>trilineata</i>
<i>Platax</i>	<i>orbicularis</i>	<i>Caesio</i>	
			<i>caeruleaurea</i>
Monocanthidae			<i>cuning</i>
<i>Ocymonacanthus</i>	<i>longirostris</i>		<i>lunaris</i>
			<i>teres</i>
<i>Cantherhines</i>	<i>dumerili</i>		

Appendix 4B: Common Reef Fishes Around Madang continue....

<i>Pervagor</i>		Aulostomidae	
<i>Acreichthys</i>	<i>janthinopterus</i>	<i>Aulostomous</i>	
	<i>radiatus</i>	Blennidae	<i>chinensis</i>
		<i>Atrosalarius</i>	
Blennidae (Continue)		<i>Meiacanthus</i>	<i>fuscus</i>
<i>Meiacanthus</i>	<i>atrodorsalis</i>	<i>Scomberoides</i>	
	<i>latovittata</i>		<i>lysan</i>
	<i>grammistes</i>	<i>Synodus</i>	
<i>Exallias</i>			<i>ulae</i>
<i>Ecsenias</i>	<i>brevis</i>		<i>variegatus</i>
		<i>Scorpaenopsis</i>	
<i>Plagiotremus</i>	<i>sp</i>		<i>oxycephala</i>
	<i>laudanum</i>	<i>Pterois</i>	
Gobiidae			<i>antenatta</i>
<i>Amblygobius</i>		Pseudochromidae	
	<i>rainfordi</i>	<i>Psuedochromis</i>	
<i>Gunnelichthys</i>			<i>fuscus</i>
	<i>curiosus</i>		<i>pacagnellae</i>
<i>Gobiodon</i>		Microdesmidae	
	<i>citrinus</i>	<i>Ptereleotris</i>	
	<i>echinocephalus</i>		<i>evides</i>
Cirrhitidae		Kyphosidae	
<i>Cirrhitichthys</i>		<i>Kyphosus</i>	<i>cinerascens</i>
<i>Paracirrhites</i>	<i>falco</i>		<i>vaigiensis</i>
		Scombridae	
	<i>forsteri</i>		<i>kangurta</i>
	<i>arcuatus</i>	<i>Euthapterus</i>	
Carangidae			<i>affinis</i>
<i>Caranx</i>	<i>lugubris</i>	<i>Seriola</i>	

Appendix 4

Issues from the impact

area communities

APPENDIX 4: Issues from the impact area communities

Summary of Key Findings

- Major improvement needs to be made to all aspects of the PMIZ project design and implementation. The current issues include: poor community understanding of processes; poor training and awareness programs to encourage ongoing community participation in all aspects of project design, delivery, implementation and review; poor use of technical resources to support project uptake by communities; little to no voice for women and children with marginal to no impact projects being supported; inconsistent allocation of similar projects across villages, and; poorly conceived projects with little chance of sustainability.
- Unresolved differences between community members themselves. Clashes between beneficiaries mean that communities are not cooperating to improve their own situation.
- Major development partners are not working together to enhance project design and delivery and there is evidence of duplication and neglect (RD Tuna, the National Government, Madang Provincial Government, etc).
- Evidence that communities are not satisfied with leadership arrangements and the sharing of power and resources.
- The current RD Tuna Project has not offered many positive changes to the lives of communities. In fact all three communities complained that over the many years this project has not brought tangible benefits and instead only disruption their lifestyle.

The social impact assessment of the PMIZ project is timely. A significant outcome of the PMIZ project will be the requirement to establish an entity that will represent all affected communities. The PMIZ project, undergoing a design process, is expected to provide an opportunity for resetting the guidelines and increasing resources for development projects in the affected communities, as well as allowing for stakeholders to collaborate more effectively for this purpose. Within this context, the communities can use these impact assessment findings to enhance its position and performance in the medium term to become a leading stakeholder when it eventually joins the broader development initiative brought about by the PMIZ project.

Table 1 : Social Impact Analysis

Main Issue	Related to main issue	Summary of views and comments	Anticipated Impacts	Possible action by the State
1. Land ownership	<ul style="list-style-type: none"> • Compensation • Negotiation • 99 year lease arrangement • Legal/illegal acquisition • Dispute resolution 	<ul style="list-style-type: none"> • People are questioning the land acquisition process. They feel that the state and RD Tuna cheated or acquired the land fraudulently after the 99 year lease expired. • They seek clarification and adequate compensation of the land. • They are seeking legal interpretation. 	<ul style="list-style-type: none"> • Impact communities could continue to stall and/or sabotage the project. 	<p>Proper and genuine consultation process is undertaken with the disputing communities. It is important that the state explain the acquisition process to the disputing communities. This is important for future and long term working relationship with impact communities.</p>
2. Livelihood	<ul style="list-style-type: none"> • Traditional fishing grounds • Food security • Cultural practices • Dynamite fishing • Use of poison vines for fishing • Exchange of sex for fish 	<ul style="list-style-type: none"> • Concerned about loosing their fishing grounds. • There are current local threats such as fishing using dynamite and poison vine. • No serious study into understanding livelihood of people by the project. People are dependent on fishing and marine products. • On small scale with current operations, women are forced to exchange sex for fish. This can get worse. 	<ul style="list-style-type: none"> • Loss of traditional fishing grounds • As population is largely semi-subsistence, food security could be a problem. • Increase rate of women forced to exchange sex for fish • Other social-issues may arise 	<p>The project needs to incorporate these aspects of community concerns into its project design.</p> <p>Possible actions could include:</p> <ul style="list-style-type: none"> • Active involvement in project activities • Training and development in spin-off activities that arise • Education support to impact communities • Strong gender policy be developed by the project
3. Migration	<ul style="list-style-type: none"> • Population increase • Employment • Government services • Disease • Crime • Prostitution • Customary land 	<ul style="list-style-type: none"> • There will be increase in number of people moving into the area from outside. • Increase in squatter settlements and encroachment into customary land. • Currently have several half-caste children of both Philippines and 	<ul style="list-style-type: none"> • New Squatter settlements could arise and encroach into customary land leading to disputes among traditional land owners and settlers. • Increase in prostitution 	<ul style="list-style-type: none"> • Clear awareness to landowners regarding social impacts. The developer (State) must set aside funding support to assist communities develop mitigation strategies.

Main Issue	Related to main issue	Summary of views and comments	Anticipated Impacts	Possible action by the State
	<ul style="list-style-type: none"> • alienation • Disputes/conflicts • Squatters 	<p>PNG. Prostitution will become a problem. This is at smaller scale, with increase number of factories the intensity would be much higher</p>	<ul style="list-style-type: none"> • among women • Defragmentation of traditional and cultural ways of doing things. 	<ul style="list-style-type: none"> • Conduct proper community mapping exercise within the impact and neighboring communities • Use above information to establish ILGs for all communities and demarcate land boundaries for registration. This will enable easier management of land related conflicts
4. Natural Environment	<ul style="list-style-type: none"> • Waste disposal • Marine species • Coral reefs • Climate change • Migration of fish stock 	<ul style="list-style-type: none"> • Economic analysis of the project needs to be reviewed. Eastern pacific fish (tuna) stock is said to be almost depleted, the western pacific stock cannot last long at the expected rate harvest. • The impact and influence of climate change on temperatures of main water bodies/currents in PNG and the western pacific needs to be factored into the economic analysis of the project • Mining activities within the Bismarck Solomon Sea dumping into the sea as well as deep sea mining could affect water quality for tuna stock: Ramu Nickle & cobalt mine, Simberi Gold Mine, Maringo mine, Nautilus Sea bed mining. • There are also other operations in PNG dumping into sea: various fish canaries (Wewak, Lae) and other development projects. 	<p>Factors such as climate change, current tuna stock, effect deep sea dumping and mining could lead future problems in the profitability of the project or its long term sustainability.</p>	<p>Review economic analysis of the project taking into consideration these factors.</p> <p>This will be important as an awareness tool as well for impact communities, civil society and the general public. It will also strengthen investor confidence.</p>
	<ul style="list-style-type: none"> • Protected areas 	<ul style="list-style-type: none"> • There are several protected 	<ul style="list-style-type: none"> • These protected areas 	<ul style="list-style-type: none"> • Open consultation with

Main Issue	Related to main issue (Locally Managed Marine Areas and Wildlife Management Areas)	Summary of views and comments areas within the Madang Lagoon area of which PMIZ project will be established. These include Tab Island Wildlife Management Area and other similar areas (need map of these areas -- see Ted Mama or Rose Singadan)	Anticipated Impacts are likely to be affected in terms of their key species protection regime	Possible action by the State
		<ul style="list-style-type: none"> Destruction of mangrove and reef ecosystem. 	<ul style="list-style-type: none"> Reduction in coastal fishery products loss of tourism potential of the area as a means of income for local people 	<ul style="list-style-type: none"> DEC staff responsible for protected areas and develop strategies on how these can be managed. Legal advice be sought to clarify implications that may arise. Consultation with impact communities on these protected areas be done with diligence to reach consensus and relevant actions.
		<ul style="list-style-type: none"> Shoreline may erode faster resulting in local villages displaced. 	<ul style="list-style-type: none"> Coastline communities will be displaced as coastline erodes Resettlement issues may arise as a result of displacement Aesthetic value of the area and tourism potential can be destroyed Impact area people may not have all the necessary skills to work in the project and outside skilled people 	<ul style="list-style-type: none"> Restriction of excavation and dredging within the immediate project area. Greater care to be taken in excavation and dredging. During this operation DEC staff and impact communities are present as observers to ensure care is taken. Project design to take this possible factor into consideration. Shoreline reinforcements and/or controls to be placed to break wave action in nearby areas A strategy be developed to cater for possible resettlement A policy be developed that provides for preference to be given to impact area skilled persons. Department of Labour be
5. Employment	<ul style="list-style-type: none"> Outside technical expertise Local work force Rempi and Kananam locals not given 	<ul style="list-style-type: none"> Email received that people from Philippines will be brought into work at PMIZ.... Local people are lazy and have bad attitude. People brought in from 		

	employment preference	Summary of views and comments	Anticipated Impacts	Possible action by the State
<ul style="list-style-type: none"> Local work force skills improved and knowledge enhanced 	<ul style="list-style-type: none"> Philippines have no proper ethics and may not respect local people's way of life Concern that this is strategy from populated nations to move cheap labour elsewhere. 	<ul style="list-style-type: none"> Skilled impact area people may be overlooked as a result of stereotype that locals are lazy with bad attitudes. This could lead to negative reaction from impacted communities Conflicts may arise among Philippine workers and national workers that could disrupt operations 	<ul style="list-style-type: none"> involved in designing overseas labour arrangements where capacity building of nationals is factored in Limit overseas labour to skilled persons only and ensure all work permit criteria are complied with by all overseas workers 	
<p>6. Economic analysis / consultation</p> <ul style="list-style-type: none"> Tourism Local participation Contracting 	<ul style="list-style-type: none"> Is there a cost-benefit analysis on different options of projects that can be established in the area before decision is made to undertake the PMIZ project? Tourism is currently the key income generation activity. Need the results of analysis to be made available. Need this development activity, but people need to work on this properly and in proper consultation. 	<ul style="list-style-type: none"> PMIZ may not be the desirable long term economically viable project People will continue to question the basic economics of project against what could have been, such as tourism. 	<ul style="list-style-type: none"> Do a cost-benefit analysis and circulate the findings and discuss with impact communities and other stakeholders (See also point 4. Natural Resources above). 	
<p>7. Current practices - experiences from RD Tuna Operations</p> <ul style="list-style-type: none"> Waste disposal: Oil spills, Disposal of dead fish and parts Prostitution Sex for fish Careless operations - transfer of fish 	<ul style="list-style-type: none"> Oil spills had been a problem with current one factory operating; the magnitude of effect could be 10 fold with the proposed project. Lots of dead fish found in the wharf area recently, there needs to greater care taken in transfer of fish from boat to landing. Disposing of dead fish and fish 	<ul style="list-style-type: none"> Deaths may occur among impact communities as a result of consumption of contaminated water (a case of this was recorded by communities). Increase shark attacks as a result of dumping of 	<ul style="list-style-type: none"> Oil spill response systems to be in place. Stringent monitoring mechanism be adopted to ensure compliance Develop a mechanism to share by catch with impact communities Use fish parts to develop other by products such as 	

Main Issue	Related to main issue	Summary of views and comments	Anticipated Impacts	Possible action by the State
		<p>parts had been careless and this could be a risk for impact communities and neighbours.</p> <ul style="list-style-type: none"> Other issues are pointed out in sections above 	<p>fish parts and dead fish (by catch) into sea</p>	<p>feed for livestock and poultry</p>
	<ul style="list-style-type: none"> Training and development 	<ul style="list-style-type: none"> No training and develop plans had been practiced by the company. This is unfair and should not be repeated. 	<ul style="list-style-type: none"> Local people and nationals may not have the necessary skills in fisheries project operations 	<ul style="list-style-type: none"> Training and development be an integral part of agreements signed with developers in the PMIZ project
	<ul style="list-style-type: none"> Employment conditions 	<ul style="list-style-type: none"> Employment conditions for local workers are poor, concern that best practices under labour laws are being overlooked. Same should not be repeated with PMIZ. Many employees are from outside, very few are from impact area communities 	<ul style="list-style-type: none"> Locals and nationals could be disadvantaged and conflicts may arise that could stall or affect performance of the project 	<ul style="list-style-type: none"> Clear employment guidelines be laid out in consultation with Department of Labour.
	<ul style="list-style-type: none"> Spin-off benefits 	<ul style="list-style-type: none"> Many promises made with impact communities. To date none has eventuated 	<ul style="list-style-type: none"> Communities will continue to raise concerns and may affect operations of the project 	<ul style="list-style-type: none"> Spin-off benefits need to be part of the project design and supported by the State
	<ul style="list-style-type: none"> Compliance with International Standards 	<ul style="list-style-type: none"> RD spends whole day cleaning up the operation area before visits by EU and NFA. Some means of independent evaluation need to be done to improve operations. 	<ul style="list-style-type: none"> Working conditions could continue to deteriorate if actions are not taken 	<ul style="list-style-type: none"> A monitoring regime be put in place by the Project Management Team to ensure standards are maintained.
	<ul style="list-style-type: none"> Maritime laws and safety regulations 	<ul style="list-style-type: none"> Local and national labour force will know the basic laws and regulations and will demand for right things to be done, the labour force from Philippines will not care about these laws and regulations and may abuse it. 	<ul style="list-style-type: none"> Reputation of products from PNG could eventually be affected Workers safety concerns may arise. Accidents may occur regularly on boats resulting in negative publicity of products from PNG 	<ul style="list-style-type: none"> Institute stringent monitoring regime Develop monitoring regimes on fishing boats that ensure compliance on boats.

Appendix 5 – 1: Short Term Concerns as a result of site clearance, construction and wharf facility construction

Activity	Environmental Consequence	Environmental Impact	Human Health and Welfare Impact	Mitigation Measures
Site clearance / grading	<ul style="list-style-type: none"> • Denuded landscape • Altered soil profile • Altered topography • Oil spills 	<ul style="list-style-type: none"> • Soil erosion • Water quality degradation • Habitat destruction and species loss • Increase run-off • Increased risk of land spillage • Toxicity: <ul style="list-style-type: none"> - Ocean disposal: species loss - Land disposal: leachate damage 	<ul style="list-style-type: none"> • Impact area communities and Worker safety • Destruction of cultural resources <ol style="list-style-type: none"> 1. Archeological sites 2. Sacred sites – freshwater lake • Welfare losses: (1) Subsistence – garden areas; (2) Recreation; (3) Economic: fisheries, tourism • Loss of potentially productive land • Cultural displacement • Aesthetic 	<ul style="list-style-type: none"> • Design and siting: avoid high quality areas. • Archaeological survey / excavation • Grading controls: (1) drainage berms; (2) settling basins • Relocation of displaced population • Rescheduling to do clearing and grading during relatively dry period. • Consultation with impact communities on alternative land for subsistence purposes
Excavation, dredging/ disposal of dredge spoils	<ul style="list-style-type: none"> • Turbidity • Sedimentation • Benthic destruction • Dredge spoils • Oil spills 	<ul style="list-style-type: none"> • Degradation of water quality • Destruction of habitat and loss of species • Toxicity: <ul style="list-style-type: none"> - Ocean disposal: species loss - Land disposal: leachate damage 	<ul style="list-style-type: none"> • Public health risk <ul style="list-style-type: none"> - Ciguatera correlation • Welfare losses: (1) subsistence, (2) recreation, (3) economic: fisheries, tourism • Impact area communities and Worker safety • Loss of potentially productive land • Aesthetic value 	<ul style="list-style-type: none"> • Design and siting: avoid high quality areas. • Siltation controls: (1) silt curtains; (2) settling ponds; (3) appropriate technology • Productive use of dredge spoils • Compensatory habitat enhancement • Organisational Health and Safety Policy • Occasional wetting
Construction of roads, bridges, drainage	<ul style="list-style-type: none"> • Noise • Fugitive dust • Machinery emissions • Structural addition to coast and landscape • Oil spills 	<ul style="list-style-type: none"> • Disturbance of endangered species • Toxicity: species / habitat loss • Water quality degradation • Eutrophication • Toxicity: <ul style="list-style-type: none"> - Ocean disposal: species loss - Land disposal: leachate damage 	<ul style="list-style-type: none"> • Impact area communities and Worker safety • Public health risk <ol style="list-style-type: none"> 1. Respiratory irritation • Welfare losses: (1) quality of life, (2) subsistence, (3) recreation • Aesthetic 	<ul style="list-style-type: none"> • Noise and emission control laws and regulations • Toxic substance control protocols • Timing to avoid migratory or spawning seasons • Compensatory enhancement • Organisation Health and Safety Policy • Occasional wetting of cleared land • Land filling
Labour importation	<ul style="list-style-type: none"> • Immigrant worker population • Sewage • Temporary housing 	<ul style="list-style-type: none"> • Water quality degradation 	<ul style="list-style-type: none"> • Public health risk <ol style="list-style-type: none"> 1. Disease introduction 2. Sanitation problems • Over burdening of infrastructure • Cultural conflicts • Loss of labour from productive sectors 	<ul style="list-style-type: none"> • Minimise contact between temporary workers and local people • Construction of housing adequate for post-construction period • Infrastructure enhancement integrated with project design

Appendix 5 - 2: Operations / Long Term Concerns as a result of site clearance, construction and related work

Activity	Environmental Consequence	Environmental Impact	Human Health and Welfare Impact	Mitigation Measures
Maritime wastes and effluents (from accommodation)	<ul style="list-style-type: none"> Organic petroleum residues Heavy metals Sewage effluent Anti-fouling compounds 	<ul style="list-style-type: none"> Water quality degradation Toxicity: species / habitat loss Eutrophication Change in ecosystem structure 	<ul style="list-style-type: none"> Public health risk Welfare losses <ol style="list-style-type: none"> Subsistence Recreation Economic (fisheries, tourism) Aesthetic value Clean-up costs 	<ul style="list-style-type: none"> Discharge regulations Shoreside collection facilities Education Enforcement
Oil spills: <ul style="list-style-type: none"> Chronic Catastrophic 	<ul style="list-style-type: none"> Oil and oily waste POL Decomposition products Floating, suspended, and dissolved pollutants Detergents from clean-up action 	<ul style="list-style-type: none"> Acute toxicity: species / habitat loss Water quality degradation Intertidal habitat degradation Change in ecosystem structure Coating of birds and animals 	<ul style="list-style-type: none"> Public health risk (long term) Welfare losses <ol style="list-style-type: none"> Subsistence Recreation Economic: fisheries, tourism Catastrophic risk (cost of clean up) Aesthetics of water and beach 	<ul style="list-style-type: none"> Emergency response plan – cleanup and removal. Design specific safeguards <ol style="list-style-type: none"> Containment structures Overflow controls
Coastline modification <ul style="list-style-type: none"> Harbour configuration Coastal topography 	<ul style="list-style-type: none"> Altered physical oceanography High residence times 	<ul style="list-style-type: none"> Beach erosion / accretion Sand transport Change in ecosystem structure Eutrophication Accumulation of wastes 	<ul style="list-style-type: none"> Public health risk Welfare losses <ol style="list-style-type: none"> Property Recreation Economic (e.g. nearshore fishery) Aesthetic 	<ul style="list-style-type: none"> Comprehensive predesign phase environmental survey Appropriate site-specific design Compensatory preserves
Runoff <ul style="list-style-type: none"> From shore Delivery by stream 	<ul style="list-style-type: none"> Sediments / organics Toxics Inorganic nutrients 	<ul style="list-style-type: none"> Water quality degradation Toxicity: species / habitat loss Eutrophication Change in ecosystem structure 	<ul style="list-style-type: none"> Public health risk Welfare losses <ol style="list-style-type: none"> Subsistence Recreation Economic (fisheries, tourism) Aesthetics 	<ul style="list-style-type: none"> Drainage control systems <ol style="list-style-type: none"> Ponding basins Storm drain maintenance
Land-use changes	<ul style="list-style-type: none"> Secondary development Enhanced access 	<ul style="list-style-type: none"> Urbanisation Overfishing / resource depletion Change in ecosystem structure 	<ul style="list-style-type: none"> Public health risk <ol style="list-style-type: none"> Air pollution Water pollution Welfare losses <ol style="list-style-type: none"> Quality of life Loss of agricultural land Overburdening of infrastructure Aesthetics 	<ul style="list-style-type: none"> Landuse planning and control Resource management <ol style="list-style-type: none"> Catch limits Education Appropriate site selection avoiding sensitive areas
Solid waste	<ul style="list-style-type: none"> Waste from human 	<ul style="list-style-type: none"> Water and air quality 	<ul style="list-style-type: none"> Public health risk 	<ul style="list-style-type: none"> Plentiful supply of litter

Activity	Environmental Consequence	Environmental Impact	Human Health and Welfare Impact	Mitigation Measures
disposal	<ul style="list-style-type: none"> • activities pollutes water and soil • Leaching from landfills or dumps • Smoke and fumes from burning 	<ul style="list-style-type: none"> • degradation • Toxicity: species / habitat loss • Marine life entanglement 	<ul style="list-style-type: none"> • Welfare losses 1. Economic (tourism) • Aesthetics • Clean-up costs 	<ul style="list-style-type: none"> • receptacles • Routine clean-up • Adequate treatment and disposal technology
Land based sewage effluent	<ul style="list-style-type: none"> • Suspended solids • BOD • Pathogenic organisms • Chlorine • Freshwater demand • Toxic industrial waste 	<ul style="list-style-type: none"> • Water quality degradation • Eutrophication • Toxicity: species / habitat loss 	<ul style="list-style-type: none"> • Public health risk 1. Pathogenic exposure / transmission 2. Food web toxic accumulation • Welfare losses 1. Subsistence 2. Recreation 3. Economic (fisheries, tourism) • Aesthetics • Clean-up costs 	<ul style="list-style-type: none"> • Waste management program
Habour operations (terrestrial and marine)	<ul style="list-style-type: none"> • Noise • Congestion / traffic • Hazardous material concentration 	<ul style="list-style-type: none"> • Disturbance of endangered species • Toxicity: species / habitat loss 	<ul style="list-style-type: none"> • Welfare losses 1. Quality of life 2. Economic (time costs) • Public safety risk 	<ul style="list-style-type: none"> • Vessel operation management • Noise control regulations • Toxic substance controls