

Esso Highlands Limited



Papua New Guinea LNG Project

**Environmental and Social Management Plan
Appendix 24: Company Community Health,
Safety and Security Management Plan**

PGGP-EH-SPENV-000018-028

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Attachment 2: Community Health, Safety and Security Management Plan – Strategic Framework

Attachment 3: PNG Demographic Surveillance Systems (DSS)

1.0 INTRODUCTION

Esso Highlands Limited (Company) has developed this Community Health, Safety and Security Management Plan (CHSSMP) describes actions that will be undertaken by Company to manage potential risks and impacts to the Project Impact Area relating to:

- Community Health;
- Community Safety; and
- Community Security.

The CHSSMP analyses, considers and develops specific monitoring and evaluation (M&E) plans based on the findings in the Health Impact Assessment. M&E is one of the most important steps in the entire HIA – CHSSMP process. A system for verifying that implementation has occurred and is achieving the intended results will be developed.

The CHSSMP describes key steps that must be considered:

- Develop and scope a formal demographic surveillance system;
- Close identified data gaps;
- Evaluate performance indicators;
- Develop participatory monitoring approaches in key Project Impact Areas so that a range of stakeholders concerns in the M&E process are considered;
- Define roles and responsibilities;
- Integrate activities with other mitigation programs;
- Develop an overall implementation timeline and schedule;
- Propose realistic budgets and resources matching scope and schedule; and
- Integrate an internal QA/QC and monitoring and evaluation system into the plan.

The CHSSMP considers:

- Types of health protection processes that may be required;
- Availability of different mitigation strategies;
- Timelines of mitigation strategies;
- Availability of interim measures or modifications;
- Cost/benefit of the proposed actions; and
- Local stakeholder engagement and participation.

CHSSMP addresses safety and security from a community perspective only. Workplace Safety & Project Security are managed by other departments.

The CHSSMP is to be read in conjunction with the following documents:

- CMP – Community Impacts (PGGP-EH-SPENV-000018-22);
- CMP – Community Infrastructure (PGGP-EH-SPENV-000018-20);
- CMP – Camp Management (PGGP-EH-SPENV-000018-24);
- CMP – Labor and Working Conditions (PGGP-EH-SPENV-000018-23);
- Water Management Plan (PGGP-EH-SPENV-000018-007);
- Waste Management Plan (PGGP-EH-SPENV-000018-006);
- Hazardous Material Management Plan (PGGP-EH-SPENV-000018-009);
- Spill Prevention and Response Plan (PGGP-EH-SPENV-000018-008);
- Induced Access Management Plan ((PGGP-EH-SPENV-000018-014);

- Hazardous Material Management Plan (PGGP-EH-SPENV-000018-009);
- Project Security Management Plan (PGGP-EH-SPSC-000003);
- Air Emissions Management Plan (PGGP-EF-APENV-000018-004); and
- Noise & Vibration Management Plan (PGGP-EH-SPENV-000018-005).

Attachment 1 summarizes relationships between the four plans that specifically deal with health and safety issues (Project Health Plan, Community Health & Safety Plan, Company Health, Safety & Security, and Community Impacts).

2.0 OBJECTIVES

The objectives of the Community Health, Safety and Security Management Plan are:

1. To avoid or reduce risks to and impacts on community health during project life cycle from both routine and non-routine circumstances;
2. To ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security; and
3. Establish monitoring and evaluation (M&E) program that is community based, participatory, transparent and covers all phases of construction, operations and decommissioning.

3.0 REGULATORY FRAMEWORK

The Company intends that relevant PNG legislative requirements, applicable international standards and guidelines, as well as relevant Company policy and commitments, will guide the management of the construction through decommissioning phases of the Project from an environmental and social perspective, including Community Health, Safety and Security.

3.1 International Guidelines and Standards

Various international standards and guidelines apply to community health. Those that are relevant to the Project activities include:

- IFC Performance Standard 4: Community Health, Safety and Security. The objective of which is to:
 - Avoid or minimize risks and impacts on the health and safety of the local community during the Project life cycle from both routine and non routine circumstances; and
 - Ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security.
- IFC Performance Standard 1: Social and Environmental Assessment and Management System;
- 'The Migration Effect'- Risk Assessment and Management Strategies for Addressing Project-Induced In-Migration; IFC, 2009;
- IFC's Good Practice Note on HIV/AIDS in the Workplace (IFC, 2004);
- IFC Introduction to Health Impact Assessment Toolkit, 2009;
- IPIECA Health Impact Assessment Guidance document; and
- International Labor Organizations Code of Good Practice on HIV/AIDS.

In relation to community security, the following international guidelines are relevant:

- Voluntary Principles on Security and Human Rights;
- U.N. Code of Conduct for Law Enforcement Officials; and

- U.N. Basic Principles on the Use of Force and Firearms by Law Enforcement Officials.

3.2 International Treaties and Conventions

There are no specific treaties and conventions addressing community health, safety and security.

4.0 PROJECT DESCRIPTION

The Company proposes to develop the Papua New Guinea Liquefied Natural Gas Project (Project) to commercialize gas reserves in the Southern Highlands and Western provinces of Papua New Guinea by processing the gas and then transporting it via pipeline from these provinces through Gulf Province and the Gulf of Papua to LNG producing and exporting facilities in Central Province (Figure 1).

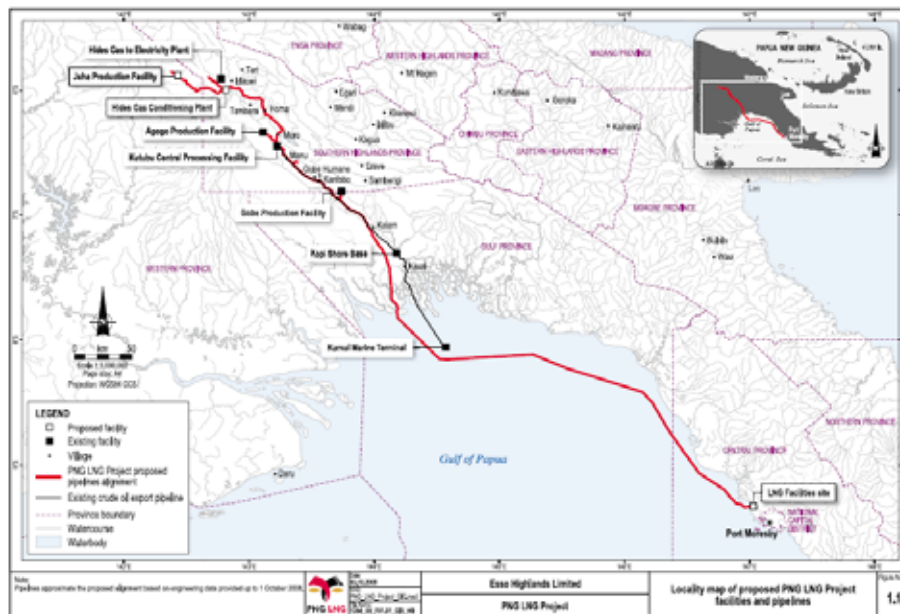


Figure 1: Project Locality Map

The Project is expected to have a life of some 30 years and has the potential to substantially boost the PNG economy. The Project is consistent with the constitutional goals and directives of the country and will bring benefits in the form of royalties, direct and indirect taxation, improvements in the nation's balance of trade and employment opportunities. In addition, the Project creates the potential for new industrial development with significant positive revenue and employment effects in Papua New Guinea.

The Project will enhance and expand existing production fields and facilities developed in Southern Highlands Province in the 1990s, constructing a portion of the Project adjacent to or within the footprint of the existing oil production and transport facilities and infrastructure from Kutubu to Kapi.

The natural gas that will be used as feed gas for LNG processing will be produced from gas fields at Hides, Angore and Juha; via the Hides Gas Conditioning Plant and the Juha Production Facility and other gas fields at South East Hedinia and the existing oil fields via the existing facilities at Kutubu, Agoro and Gobe. The natural gas will be conditioned and then transported via an onshore pipeline to the Gulf of Papua and then via an offshore pipeline to the onshore LNG Plant some 20 km northwest of Port Moresby at Caution Bay, where it will be liquefied and then exported via LNG carriers to international gas markets. In addition to LNG, the Project will produce some condensate at Hides and at the LNG Plant. The former will be transported via pipeline to storage tanks at Kutubu and then exported via

the existing crude oil pipeline to the existing Kumul Marine Terminal; the latter will be stored in tanks at the LNG Plant and then exported via condensate carriers.

A schematic presentation of the existing oil and gas facilities in the region and new facilities to be developed as part of the Project is presented in Figure 2.

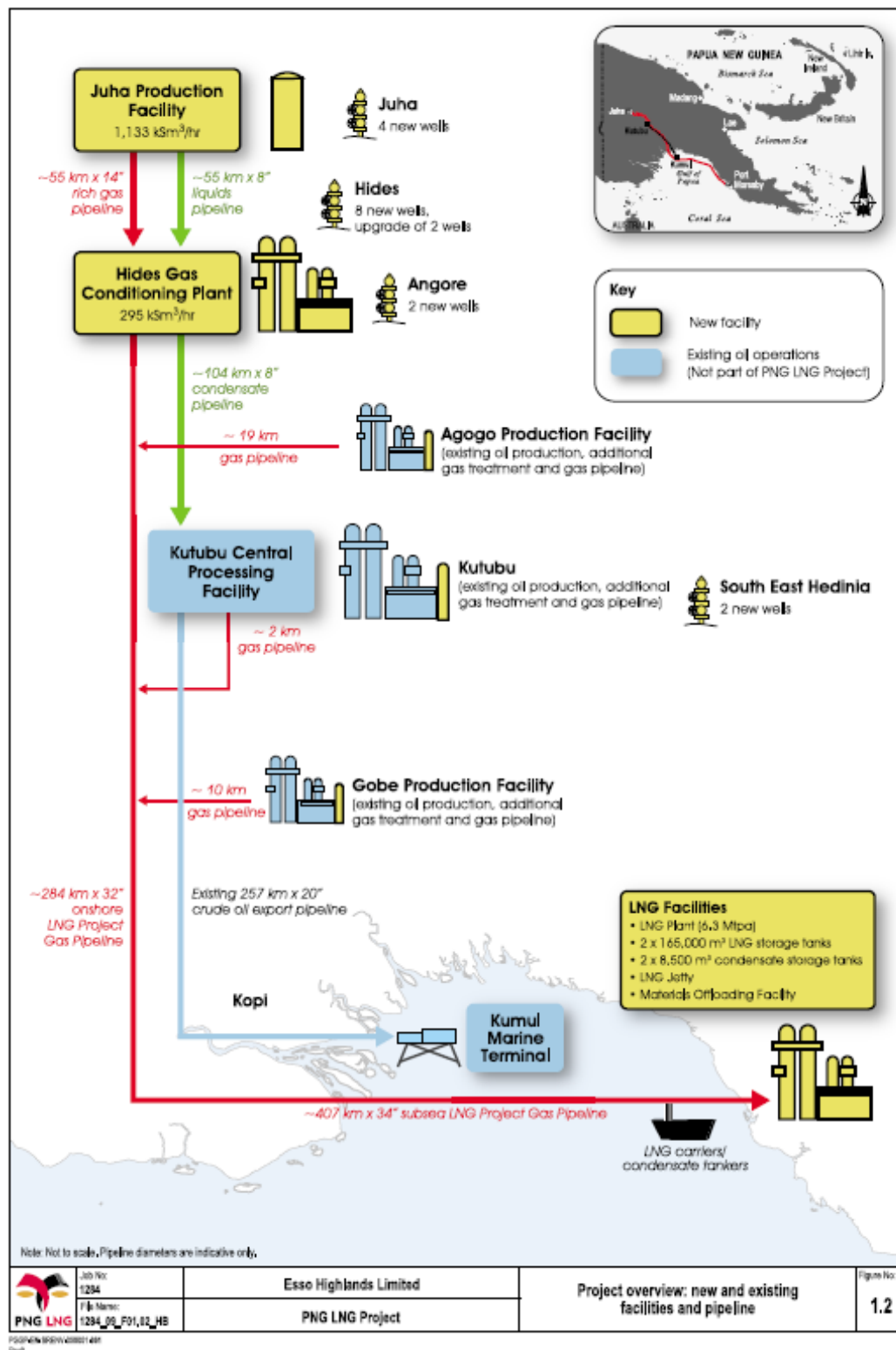


Figure 2: Overview of Major Project Facilities

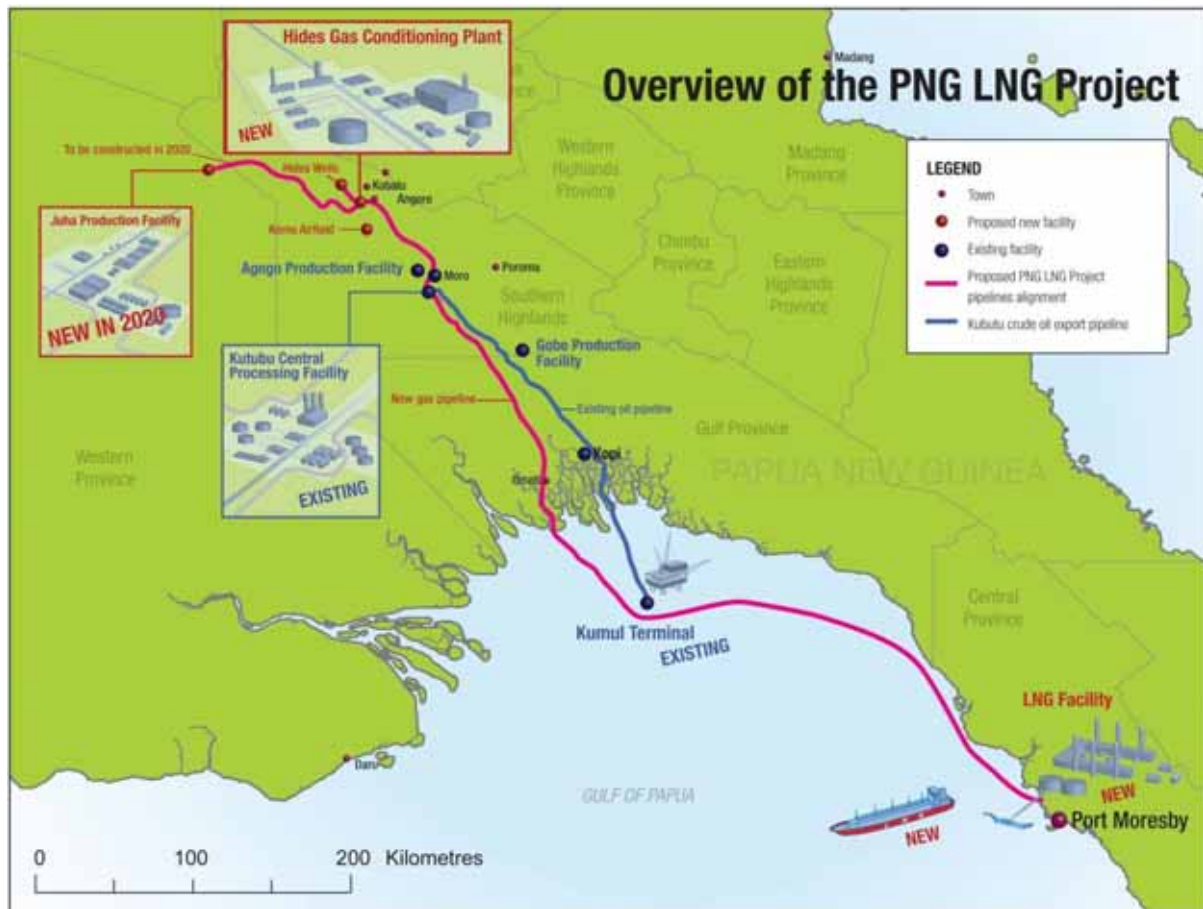


Figure 3: Location of Major Project Components

Figure 3 illustrates (in red) those facilities that will need to be constructed for the Project and illustrates other facilities (in blue) that already exist as part of current oil operations, but which the Project will also utilize.

4.1 Co-Venture Structure

The Company will operate the Project on behalf of a group of co-venturers. Participating interests include Esso Highlands Limited as operator (33.2%), Oil Search Limited (29.0%), Kroton #2 (PNG Government 16.6%), Santos (13.5%), Nippon Oil (4.7%), Mineral Resources Development Company (PNG Landowners 2.8%), and Petromin PNG Holdings Limited (0.2%).

4.1.1 PNG LNG Development Overview

The Project is a large and complex operation that is broadly split into two parts – Construction – which is expected to take place between 2009 and 2014, and Production – which is expected to run from 2014 to around 2044.

4.1.1.1 Construction

Main Activities by Area and Timing

The following expands on the various phases of Construction required by the Project. Early Works and Construction (Phase 1) will take place from late-2009 to end-2014. The Project will be developed in several phases, with major elements only listed below. Figure 3 is a schematic representation of the various Project components.

An early works program is part of the Project phase that applies to community health program activities, and includes:

- Establish Kopi as a Southern route point of entry including wharf, RORO, lay down, camp area and bypass road construction;
- Open up the Southern supply route including bridging the Kikori and Mubi rivers, construct 30km of new road (Gobe airfield to Kantobo) and approximately 3km of bypass roads in the Kutubu area;
- Undertake road and bridge work on the Highlands Highway so that the road is capable of supporting construction logistics. Work is primarily focused on the Mendi to Hides section; and
- Construct the Pomtech and Juni Training facilities.

Additional Project phases are listed below.

Table 1: Project Development Phasing

Phase	Proposed Facilities	Estimated Timing ¹
Phase 1: Initial Development (Hides, Angore, Kutubu and Gobe)	Hides Gas Field: Wellpads A,, B, C, D, E & G	2014
	Hides Gathering System and Spine	
	Hides-HGCP Mono-Ethylene Glycol (MEG) Pipeline	
	Hides Gas Conditioning Plant (HGCP)	
	HGCP-Kutubu Condensate Pipeline	
	Kopi Scraper Station	
	Komo Airstrip	
	LNG Project Gas Pipeline (Onshore/Offshore)	
	LNG Plant & Facilities	
	Gobe Gas Pipeline	
	Kutubu Gas Pipeline	
	Hides Gas Field: Wellpad F and B2	
	Angore Gas Field Wellpads A and B	
	LNG facility	
	Angore Gathering System and Spine to HGCP	
	Angore-HGCP MEG Pipeline	
Phase 2: Additional Compression at HGCP	HGCP Booster Compression	2019
Phase 3: Juha Field Development	Juha Gas Field Wellpads A, B, and C	2022
	Juha Gathering System and Spine to JPF	

¹ Indicates an estimated year for commencement of operations.

Phase	Proposed Facilities	Estimated Timing ¹
	Juha-JPF MEG Pipeline	
	Juha Production Facility (JPF)	
	JPF-HGCP Gas Pipeline	
	JPF-HGCP Condensate Pipeline	
	JPF-HGCP MEG Pipeline	
Phase 4: Agogo/Moran Field Development	Agogo/Moran Gas Pipeline	2024
Phase 5: South East Hedinia	South East Hedinia Wellpads A & B	2033

4.1.1.2 Production

Production

The Project is expected to have an operational life of approximately 30 years, beginning around early 2014 when the first LNG cargo is expected to be ready for shipment. Once Phase 1, the main Construction Phase, is complete and the Project enters Production, there will be a shift in the areas and types of activity for the remainder of the Project's life. Apart from routine maintenance on the pipeline, major activity will focus on operating the Hides Gas Conditioning Plant and the LNG facility near Port Moresby. These activities will require a significant, albeit smaller, workforce with different skills to those required in Construction.

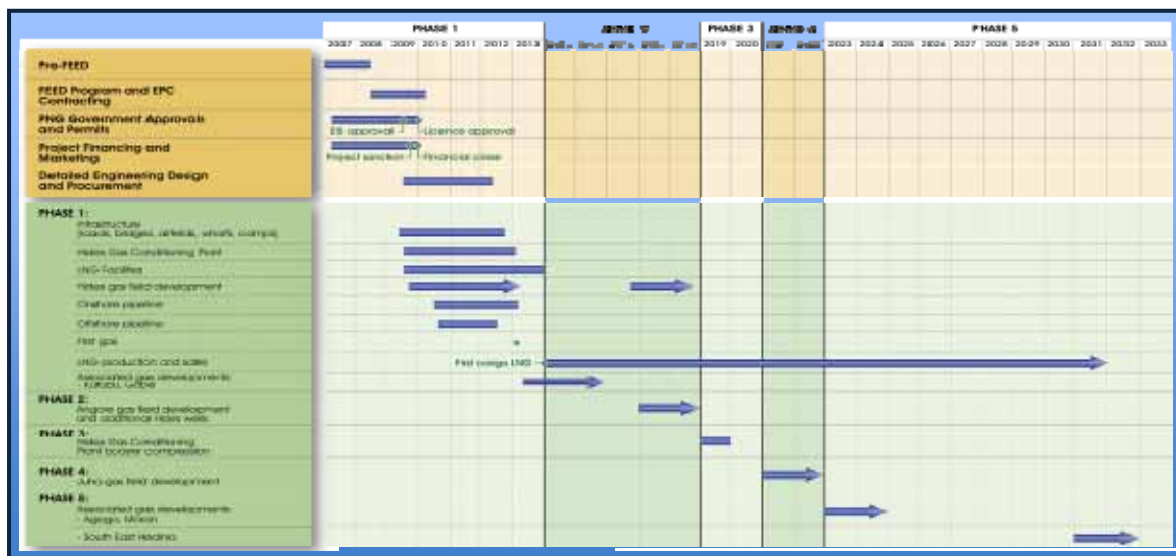


Figure 4: Schedule of Activities

For Phase 1 (Initial Development), EHL will use major Contractors to build the LNG and Gas Conditioning Plant facilities and the pipelines. Following is a brief description of the work to be completed by each of the major Contractors during the initial Construction Phase of the Project:

- CI – Infrastructure Contractor includes an Early Works component and will build infrastructure needed to provide logistics routes for the subsequent EPC Contractors;
- EPC1 Contractor will build the telecommunications systems;

- EPC2 Contractor will build the offshore pipeline and pipeline landfalls;
- EPC3 Contractor will build the LNG facility;
- EPC4 Contractor will build the Hides Gas Conditioning Plant and Hides Well pads;
- EPC5 Contractor will build the onshore pipeline and Komo Airfield; and
- Drilling Contractor will drill the wells.

5.0 BACKGROUND TO COMMUNITY HEALTH, SAFETY AND SECURITY

A community Health Impact Assessment (HIA) was performed on behalf of the Company. While health is also reviewed as part of the Environmental Impact Statement (specifically the Social Impact Assessment) described below, the HIA was developed to provide input into the development of the Company and Contractor Health, Safety and Security Management plans. The overall purpose of the HIA is to predict health impacts prior to the implementation of the Project in order to determine measures to reduce negative health consequences and enhance beneficial ones.

The HIA was developed based on established published guidelines:

- 2005 International Petroleum Environmental Conservation Association (IPIECA) Guide to Health Impact Assessment in the Oil and Gas Industry;
- 2008 International Finance Corporation (IFC) "Good Practice Notes to Performance Standard 4 "Community Health""; and
- 2009 IFC "Introduction to Health Impact Assessment".

The key objectives of the HIA were to:

- Analyze the sufficiency of baseline health data in the Project area of influence and highlight any critical data gaps;
- Evaluate the potential health impacts on individuals, populations and communities within the proposed Project area of influence;
- Employ qualitative, semi-quantitative or fully quantitative data for assessment of health impacts, where impacts can be neutral, positive or negative;
- Provide a formal mechanism that involves and engages the relevant stakeholders to ensure appropriate discussions directed towards the prevention and mitigation of negative effects on health; and
- Provide a basis or framework, for developing a formal mitigation strategy: Community Health Safety Security Impact Management Plan (CHSSMP).

The HIA conducted a detailed review of available health-related databases, including Government of PNG reports, international aid monographs, (e.g., AusAID, World Bank, Asian Development Bank, World Health Organization (WHO), etc), PNG Institute for Medical Research (PNGIMR) publications, peer-reviewed published scientific/medical articles and unpublished data available from the extensive Oil Search Ltd community outreach and medical department activities. The HIA presented a detailed appraisal of baseline health data at national, regional, provincial levels and for specific project impact areas.

The locations of many of the major potential health impacts mirrored the geographical based potentially impacted areas chosen in the Social Impact Assessment. Therefore, the HIA adopted the general framework presented in the Social Impact Assessment which selected seven areas: Hides; Juha; Moran; Moro; Gobe; Kikori; and the LNG Plant site area. The areas were systematically analyzed using an environmental health area (EHA) framework that has been published by the International Finance Corporation (IFC) and the International Petroleum Industry Environmental Conservation Association (IPIECA).

Overall, the intent of the HIA was to specifically look at impacts: direct; indirect; and cumulative, that could be logically and causally tied to the Project.

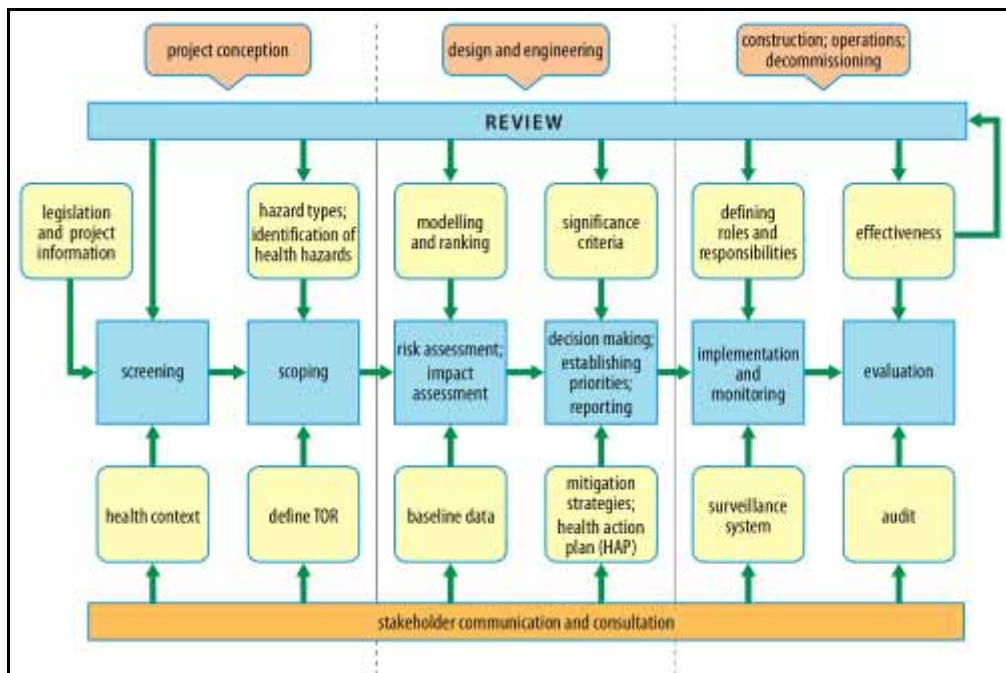


Figure 5: HIA and Impact Management Process

The CHSSMP will include potential strategies for obtaining the information needed to close critical data gaps uncovered by the HIA. The CHSSMP process is shown below.

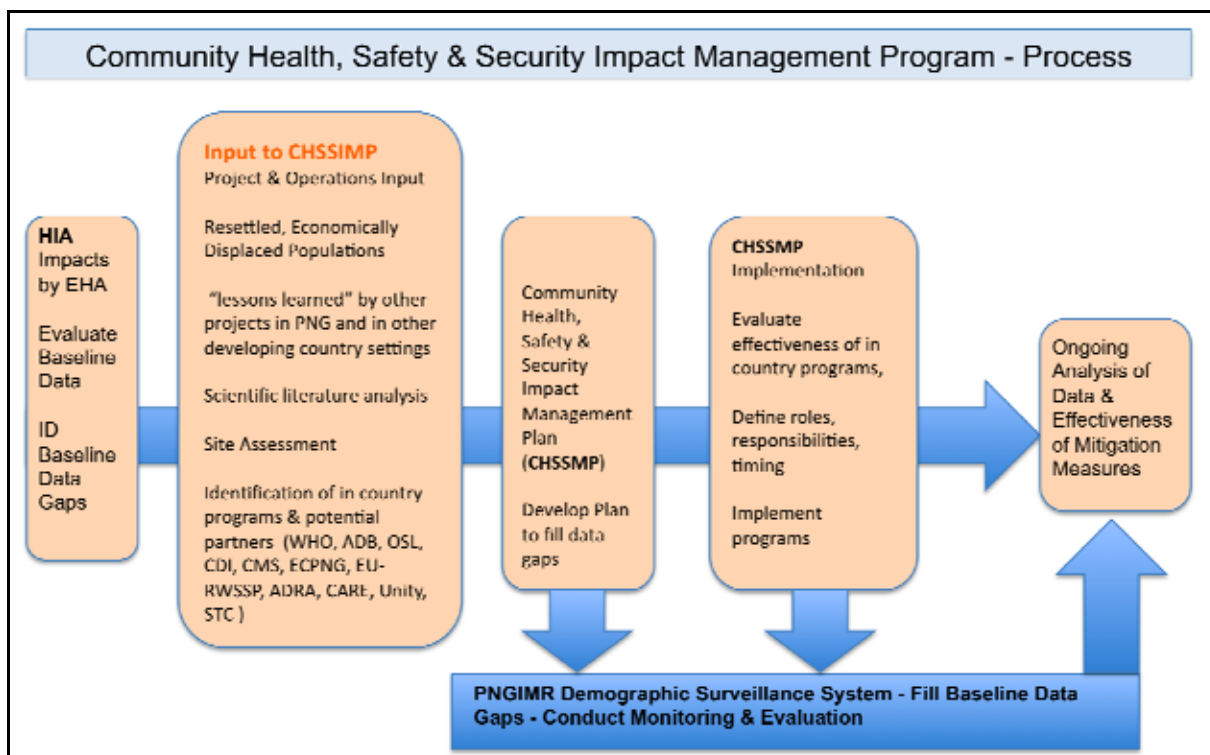


Figure 6: The Twelve Environmental Health Areas

Community Health Management focuses on 'environmental health'. Environmental health encompasses the human living environment and emphasizes primary prevention through interventions in: housing; sanitation; solid waste control; water; food; transportation; and

communication, and differentiates from “public health” with its disease specific focus. Approximately 25 to 33 percent of the global burden of disease can be attributed to environmental risk factors.

The environmental health approach includes an examination of the relationships between overall disease burden and infrastructure impacts through a cross-sectoral examination that combines and integrates the broader potential adverse and beneficial effects of non-health sectors, e.g., transportation and communication, housing, sanitation and urban development (that have been demonstrated to be significantly influenced by industrial development projects) as opposed to an assessment focused only on the immediate Project workforce.

Issues surrounding the role of PNG health infrastructure and capacity have also been considered because it is estimated that deficiencies in a developing country's health care system could account for approximately 18 per cent of the overall burden of disease.

In addition, human resource staffing and skill levels correlate significantly with health outcomes and health systems performance and are a major social determinant of the overall burden of disease. The combination of the environmental burden of disease and health systems deficiencies could account for approximately 50 per cent of the overall burden of disease.

The PIAs were systematically analyzed using an environmental health area (EHA) framework that categorizes the variety of bio-medical and key social determinants of health into twelve environmental health areas.

Table 2: Environmental Health Areas

	Environmental Health Areas (EHAs)
1	Health services infrastructure and capacity and Program management delivery systems: physical infrastructure, staffing levels and competencies, technical capabilities of health care facilities; coordination and alignment of the Project to existing national and provincial level health programs, (e.g., TB, HIV/AIDS, malaria); and future development plans.
2.	Sexually transmitted infections: HIV/AIDS; syphilis; gonorrhea; Chlamydia; genital ulcer disease; trichomonas; and hepatitis B.
3.	Vector-related disease: malaria; dengue; Japanese Encephalitis (JE) and other arboviral diseases; Lymphatic Filariasis; and ectoparasites, etc.
4.	Vaccine Preventable Diseases: pneumococcus; measles; mumps; rubella; tetanus; typhoid; etc.
5.	Soil, Water, Waste and Sanitation related diseases: geohelminths, e.g., giardia, hook and pin worms, etc.
6.	Food and nutrition related issues: changes in subsistence practices; stunting, wasting, anemia, micro-nutrient diseases (including folate, Vitamin A, iron, iodine); gastroenteritis (bacterial and viral); and food inflation
7.	Accidents/injuries and Community Safety: road traffic related spills and releases; construction; and drowning.
8.	Social Determinants of Health (SDH): psychosocial; resettlement/relocation; violence; security concerns; substance misuse (drug (including betel nut), alcohol, smoking); depression; and changes to social cohesion.
9.	Exposure to potentially hazardous materials: road dusts; air pollution (indoor and outdoor related to industrial activity, vehicles, cooking, heating or other forms of combustion/incineration); landfill refuse or incineration ash; any other Project related solvents, paints, oils or cleaning agents, by-products; noise; and illumination.
10.	Housing and Respiratory issues: acute respiratory infections (bacterial and viral); pneumonias;

	Environmental Health Areas (EHAs)
	tuberculosis; respiratory effects from housing; overcrowding; and housing inflation.
11	Non-Communicable Diseases: hypertension; diabetes; stroke; and cardiovascular disorders.
12.	Veterinary Medicine/Zoonotic Issues: potential disease distributions secondary to changes in animal migration/market selling patterns due to Project-related activities or infrastructure.

6.0 SURVEYS

Community health data are described in the PNG LNG Health Impact Assessment (HIA) document. Health data gaps identified in the HIA will be addressed by the Company using the demographic surveillance system platform managed by PNG Institute of Medical Research (PNGIMR). Attachment 3 presents specific baseline data gaps and a method for closing these data needs.

7.0 MITIGATION AND MANAGEMENT MEASURES

One of the most important benefits of the entire HIA process is the identification of issues that could be potentially avoided or minimized by focused primary project design changes, such as re-routing roadways, etc. From a health perspective, this can be considered as primary prevention of potential effects. Similarly, secondary prevention strategies can be utilized to reduce impacts at both a defined geographical location and or to a given population or community. Tertiary prevention or overt treatment (remedy) is the third level of mitigation that can be employed. Remedy interventions may include restoration or repair to essential needs like water wells or vegetable gardens. Finally, when there is irrevocable loss or damage, some type of compensation may be appropriate. Therefore, careful and consistent co-ordination with the Safety, Security, Health, Environment and Social (SSHES) Management Framework is essential.

The overall mitigation strategies are organized around two fundamental public health concepts:

- Health promotion / education defined as:
 - Any intervention that seeks to eliminate or reduce exposure to harmful factors by modifying human behaviors; and
 - Any combination of health education and related organizational, political and economic interventions designed to facilitate behavioral and environmental adaptations that will improve or protect health; and
- Disease prevention defined as:
 - Any intervention that seeks to reduce or eliminate diagnosable conditions; and
 - May be applied at the individual level, as in immunization, or the community level, as in the chlorination of the water supply.

Disease prevention is often illustrated by the prevention pyramid which is composed of:

- **Primary:** the base of the pyramid which covers population-oriented actions designed to be implemented before health problems develop;
- **Secondary:** the second level covering actual clinical preventive services for populations at high risk, where interventions are designed to prevent a condition; and
- **Tertiary:** top of the pyramid covering treatment intervention or rehabilitation with existing, serious problems.

The placement of population-oriented prevention at the base is significant due to it's:

- Focus on all of the people as recipients;
- Broad, long-lasting impact on health; and
- Role in defining and facilitating the whole system to work.

Because of the geographical extent of the Project, a combination of health promotion/education and primary disease prevention is the most efficient and cost-effective method of managing potential impacts. Therefore, a workforce health promotion/education effort spearheaded by the Company can significantly impact or influence behaviors and practices in local communities by using the Project's workforce as "peer educators and ambassadors" in their home villages. The overwhelming evidence in the prevention literature is that peer-educators are the most successful "change agents" at a household level. Therefore, the mitigation strategies propose a series of practical biological/medical approaches that are scientifically defensible and compatible with existing administrative and "political reality." Political reality refers to the problem of constructing strategies that are reasonably cost-effective, sustainable and aligned with Government of PNG plans and capacity to deliver.

Mitigation strategies do not neatly fall into "internal project" and "external community" categories. For some potential impacts, there is a continuum from the Project to the community and vice versa. The Project workforce is both a separate inside the fence line community but also simultaneously part of the wider external rural/urban environment surrounding the Project. Therefore, many of the proposed strategies originate inside the fence line and extend into specific Project Impacted Areas (PIAs). Mitigation activities, whether directed towards workers, family members or the general community, should be carefully assessed and tied to appropriate outcome indicators.

- The project will have a large national workforce which comes from geographic areas where the Project is active
- Project workers have the potential to mitigate potential negative health impacts and effect positive change at both a household and community level because they live in the potentially affected communities

In a given location, the size of the local national workforce is larger than any group of similar community activists or organizations that could be easily, cost-effectively or efficiently created and reached on a continuous basis. Therefore, using local workers is a more effective strategy in order to meet government health strategies.

A series of mitigation strategies are presented in Attachment 2 and will be developed into detailed implementation plans describing timeframes, responsibilities, collaborating agencies/organizations and performance indicators. The overall mitigation approach is tied to the demographic surveillance system (DSS) platform. The DSS is an internationally recognized system that is community based, participatory and scientifically rigorous. Appropriate control communities are also monitored and used for comparison. The DSS provides real time, objective information that is used to develop any needed specific intervention measures.

The DSS is designed to capture as wide a range of information as possible since all impacts, positive or negative, cannot be fully anticipated in advance. Nevertheless, there is extensive experience with large industrial projects and issues surrounding project triggered influx. Attachment 2 reflects those impacts that are considered to be most likely, during all phases of the Project. These reasonably anticipated potential impacts are organized around the environmental health framework. Whenever possible, mitigation strategies were developed based on existing in-house programs and resources, focusing on alignment and cross utilization of in-house resources.

7.1 Environmental Health Area 1: Health Services Infrastructure

Health services infrastructure and capacity and program management delivery systems includes physical infrastructure, staffing levels and competencies, technical capabilities of health care facilities; coordination and alignment of the Project to existing national and provincial level health programs, (e.g., TB, HIV/AIDS, malaria), and future development plans

As a direct benefit from the existing petroleum projects, there have been flows of income into the Provincial Governments. However, PNG National Health Survey Statistics indicate little improvement in health service delivery for the PIA communities. In fact, health services in these areas have deteriorated. Based on independent field surveys and assessments initiated by OSL, at the very period when Provincial Governments collected most revenue, they dispensed the least services in respect to health.

Numerous problems impact the capacity of the present provincial health infrastructure to adequately service existing constituencies:

- **Drug supplies:** can be variable and often unobtainable from hospitals;
- **Training:** inadequate and insufficient training of community health workers hampers sustainability of the aid-posts;
- **Staffing:** frequently Health Extension Officers (HEOs) and Community Health Workers (CHWs) are simply unavailable, with extremely high non-attendance or absentee rates. During the HIA team field visits, many facilities had few if any staff present for many months;
- **Resources:** lack of resources for all levels of aid posts, clinics, and hospitals;
- **Cold Chain (refrigeration):** not functioning well and plagued by transport difficulties; and
- **Reporting:** reporting system is inconsistent and irregularly performed.

7.1.1 PNG Health System

Health services are provided: by both Government and church providers (both of which are financed primarily from public sector funds); by enterprise-based services (e.g., the mines); by a small, modern private sector; and by traditional healers (undisclosed amount). Within the public sector, management responsibility for hospitals and rural health services within provinces is divided. The National Department of Health manages the 19 provincial hospitals, while provincial and local governments are responsible for all other services (health centers and sub-centers, rural hospitals and aid posts), known collectively as 'rural health services'.

7.1.1.1 Health Policy, Planning and Regulatory Framework

The National Health Plan 2001-2010 and the Medium-Term Expenditure Framework 2005 – 2007 identify some priorities including:

- Maternal and child health;
- Immunization;
- Malaria control;
- TB DOTS;
- HIV/AIDS; and
- Water and sanitation programs.

7.1.1.2 Challenges to health system strengthening

Under the Organic Law on Provincial Governments and Local Level Governments, district and local governments are given responsibility to manage and support their health services. Each level of government has different powers and functions in relation to health. The National Department of Health is responsible for policy, standards, training, medical supplies, specialist services, public hospitals and monitoring, while the provincial and local governments are responsible for implementation of health policies, standards and funding programs. However, due to other district and local government priorities, almost all rural health services are underfunded.

Nurses and community health workers form the backbone of primary health care services in rural areas, and both are considered to be already in short supply and being dramatically reduced. These shortages constitute a serious constraint in implementing the National Health Plan, including the priority programs; some provinces and many districts do not have a qualified doctor on staff. The passing of the Organic Law exacerbated existing problems in health staff supervision and support. Provincial health advisers lost much of their authority to supervise and discipline district health staff. Central Department of Health oversight of provincial staff is also limited. Reasons include the limited capacity of program units at the central level; the lack of funds for travel; the lack of economies of scale through joint training and supervision across programs; and delayed disbursement of funds.

As a result rural health services are poor and deteriorating. A functional and expenditure review in 2001 described the health system in rural areas as being in a state of “slow breakdown and collapse, currently being saved from complete collapse by donors”. The review stated, “About 600 rural facilities are closed or not functioning effectively. Where services remain, the breadth and quality of the services are diminishing.” This dire situation has worsened since then, and more facilities have closed down. In spite of being acknowledged for some time, little has been done yet to seek redress. The scarcity and maldistribution of human resources has not been addressed effectively, and there have only been limited and not very coordinated efforts in training and other approaches to capacity-building. No plan for development of human resources exists.

7.1.1.3 Health Services

Levels of authority in the Papua New Guinea health system:

- National;
- Regional;
- Provincial;
- District; and
- Local level.

The 2003 National Health Facility Inventory lists all health facilities other than aid-posts and is summarized below.

Table 3: National Health Facility Inventory (2003) – Summary

	Government	Church Health Services	Other NGO	Total
Provincial hospital	20*	1	0	21
Urban clinic	41	8	10	59
Rural health centre	147	53	3	203
Rural health sub-centre	139	245	4	388
*Includes Port Moresby General Hospital in the National Capital District				

Most information on communicable disease outbreaks come from the media, instead of the National Health Information and Surveillance System. At all levels in the country there are limited capacities for outbreak response. Current central government policy of putting a ceiling on staff numbers does not allow for recruitment of more staff for the health system, especially in the peripheral areas. The National Department of Health is making an effort to strengthen communicable disease surveillance and to build outbreak response capacities by re-establishing its Disease Control Branch and recruiting staff for communicable disease surveillance and outbreak response, but the process is still ongoing.

There is some laboratory capacity and a laboratory network in Papua New Guinea, but laboratory services are generally weak. The Central Public Health Laboratory (CPHL) in Port Moresby is responsible for overall coordination of operations for communicable disease diagnosis. The regional and provincial hospital laboratories form the backbone of the country's laboratory network. Health centers also have limited laboratory diagnosis capacities. Medical supply and drug procurement and distribution face challenges and 'stock-outs' are common occurrences. The distribution system is often dependent on ad hoc solutions.

7.1.1.4 Key Constraints

Human resources – shortage and maldistribution: Nurses and community health workers form the backbone of primary health care services in the rural areas, and both are considered to be in short supply. Accurate information is limited but all reports suggest that the 1998 Public Service Reform program dramatically reduced the number of community health workers in aid posts in rural areas, one reason many rural health facilities closed. The nurse to population ratio is 150 per 100,000. An additional 1,000 nurses and community health workers and 100 midwives are estimated are required to fill vacant posts although current production rates are insufficient to fill this gap. These shortages constitute a serious hurdle for implementing the National Health Plan, but it is unclear how they can be resolved in the short term given the funds and time required. The doctor to population ratio is 13 per 100,000. The majority of doctors are located in Port Moresby, some provinces and many districts are without doctors.

Decentralization – Staff supervision and performance: About 30% of provincial government staff are health workers. The Organic Law exacerbated existing problems with health staff supervision; provincial health advisors lost much authority to supervise and discipline district health staff. These functions were transferred to provincial administrators and to district and local governments, but there is widespread belief that it is, "near impossible to discipline, let alone dismiss" staff. The transfer of senior personnel, including doctors, from rural health centers as well as the withdrawal of vehicles made outreach services and supervision almost defunct as hospitals became less involved in district supervision. Other factors cited as contributing to low staff morale and motivation are the lack of incentives such as housing and hardship allowances and long periods of isolation in remote areas.

Central NDOH oversight of provincial staff is also limited. Reasons include limited capacity of program units at central level, lack of funds for travel, lack of economies of scale through joint training and supervision across programs and delayed disbursement of funds.

7.1.2 Implications of OSL Community Health Outreach Efforts

OSL Medical Transport Data - At a recent PNG Community Health Workshop, there was significant interest regarding the:

- Potential demand for health care services that the local communities are expecting from the Project; and
- The burden of acute/emergency transport for the local community members that will arise out of the communities in the Project catchment areas.

There is a community perception that the Project will provide both general health care service delivery and emergency transport within the critical areas where construction and operations activities will occur. Community “expectations” are conditioned by the current activities of the large oil and mining projects in PNG. A large variety of health services are being provided by OSL and the major PNG mining projects, e.g., Porgera JV and OK Tedi. However, the provision of community health care services is a complex and sensitive undertaking that requires significant planning and resources. In addition, there are important long-term transition considerations that must be analyzed, i.e., sustainability issues. Hence, the level, if any, of community health service delivery that should be considered by the Project is a critical consideration. Therefore, there is a complex intersection between: (1) Company procedures and practices; (2) community expectations; and (3) existing customary practice by current industrial operators.

7.1.3 Key Messages

The following key messages have been identified:

- Bring services to the community or the community will come to you;
- Providing service at a local level, either through Aid Post/Health Centers or mobile clinics, will significantly decrease the demand at the Project fence line;
- Community clinical visits will probably continue at or near their current level in the Hides-Kikori corridor. It is uncertain how much the Project will stimulate “new demand” above and beyond the current levels experienced by OSL in the Hides to Kikori corridor;
- However, ‘new areas’, i.e., Komo, are likely to trigger increased demand although these areas are currently serviced to some degree by OSL clinics in Hides;
- LNG area communities are likely to have huge ‘pent-up’ expectations and demands for medical services as the existing Aid Post/Health centre system is functioning at a low level;
- Based on the population of around 12,000 to 16,000 in the four key villages near the LNG site, it could be anticipated (using 0.3-0.6 visits/person/year) that there would be 3-10,000 “new visits.” This calculation does not include any incremental influx that may occur near the LNG facility, which could double the area population within 2 to 3 years;
- The LNG area ‘new visits’ cannot be absorbed by the existing Aid Post/Health Centre system;
- The demand for emergency transport services will continue in the Hides to Kikori corridor;
- The demand for emergency community medical services in the Hides-Kikori corridor will continue during the Project early works and active construction stages;
- The level of transport service demand is relatively “low” for aviation and “high” for ground transport;
- Current demand in Hides-Kikori corridor could continue to be met by OSL operations as they are currently configured;
- The “incremental burden” that the Project will add is at present unquantifiable;
- Emergency community transport should be anticipated in the Project area; however, ground transport services should be sufficient; and

- The absolute volume of emergency medical ground transport activity could be high based on experience in the Highlands, particularly if there is significant influx into the Project area.

7.2 Environmental Health Area 2: Sexually Transmitted Infections - HIV/AIDS

Sexually transmitted infections: HIV/AIDS, syphilis, gonorrhea, Chlamydia, genital ulcer disease, trichomonas and hepatitis B

7.2.1 Issue

The Project will trigger economic activity across a broad geographical area; however, this economic energy is also potentially associated with:

- Significant population influx issues; and
- Potential rises in sexually transmitted infections (STIs) including HIV/AIDS.

Data from projects has indicated significant rises in STIs due to:

- Large temporary expansions of the workforce (dominated by men as a percentage of the overall workforce) during construction; and
- Increases in the number of long-haul truck trips between major urban areas, Port Moresby and the Project.

In many studies, long-haul truckers tend to have higher STI rates and acts as “core group spreaders” along major transportation routes.

7.2.2 Key Messages

The approach to mitigation will focus on supporting existing local measures aimed at reducing the incidence of objective disease. The Company goal is to prevent a significant increase of STIs within the Project area when compared to the relevant control group. The use of DSS longitudinal data and specialized STI surveys will be needed.

Point to point transportation services (transport from home village to work site and back) for workers reduces casual contact and interaction with sex workers.

7.2.3 Analysis

The Company will monitor and evaluate STIs through the DSS platform. Similarly the mitigation measures will also be delivered through this platform based on the extensive community based experience of PNGIMR.

7.2.4 Timing

Establish the DSS platform and in parallel initiate the specialized STI surveys needed to close baseline data gaps. Community outreach through the DSS platform based on baseline survey results. Immediate implementation required for work site information, education and information programs. Appropriate programs for transportation contractors should begin as soon as possible. These programs are described in the Contractor Community Health, Safety and Security Impact Management Plan.

7.3 Environmental Health Area 3: Vector Related Issues

Vector-related disease: malaria, dengue, Japanese Encephalitis (JE) and other arboviral diseases, Lymphatic Filariasis, Rickettsia and ectoparasites, etc.

7.3.1 Issue

The Project will produce large-scale civil engineering changes in the existing landscape that will have both physical and social effects:

- Physical changes involve creation of new drainage patterns (including creation of new surface water bodies and outflows, land grading and surface changes and transformation of agricultural land to industrial development;
- Intimately associated with the physical environment are a large variety of indigenous vectors (mosquitoes, flies and mites) that are capable of acting as hosts for several significant parasitical diseases. The vectors interact with human populations in complex ways that have produced an established pattern of morbidity (illness) and mortality (death). The Project has the potential to alter, positively or adversely, the nature and extent of these vectors and their associated diseases in humans; and
- Social changes are related to creation of new spatial relationships between water sources/flow patterns and human settlements.

7.3.2 Key Messages

The mitigation strategies focus on six common vector diseases already present in the Project area population:

- Malaria;
- Lymphatic Filariasis (LF);
- Dengue;
- Japanese Encephalitis (JE);
- Other arboviral diseases; and
- Rickettsial diseases.

In order to control vector breeding sites, efficient environmental management of surface water is essential, particularly during construction. Public health engineering and water management are essential strategies. Vector control in local communities using Indoor Residual Spraying (IRS) is possible; however, sustainability issues are extremely important. In addition, coordination with national vector control program authorities is essential.

7.3.2.1 Malaria – Primary Prevention Using Engineering Control

Primary prevention malaria control measures are:

- Environmental modification and manipulation; and
- Changes in man-vector contact.

These strategies are non-toxic, cost-effective, and typically sustainable. Environmental modification refers to measures that try to create a permanent or long-lasting effect on land, water, or vegetation in order to reduce vector habitats including:

- Improved surface water drainage for Project roadways and other construction activities;
- Systematic elimination of standing pools of water;
- Installation and maintenance of drains;
- Deepening, filling, leveling;
- Dyking, canal and shoreline straightening and/or alteration of slope profiles; and
- Changing of water salinity.

Although all standing water will not be able to be prevented, design plans for construction of the Project facilities, structures, etc., will address appropriate drainage, shoring, sloping, etc.

Environmental manipulation, which produces temporarily unfavorable conditions for the vector including:

- Water level management;
- Vegetation management; and
- Flooding or dewatering.

Modification or manipulation of human habitation or behavior, which reduces man–vector contact including:

- Increasing the distance between vector locations and human settlements known as dry belting (Malaria risk generally increases with proximity to breeding sources). In some cases, a progressive gradient of risk can be demonstrated in homes adjoining well-defined breeding sources;
- Mosquito proofing Project houses and tanks;
- Improved design and construction of Project housing, closing eaves and bed nets.

Malaria and Project Housing

The focus on mitigation measures related to Project housing and malaria transmission in the community is related to the fact that a project can:

- Design, build or positively influence the design of resettlement housing in order to prevent mosquito entry, including screening strategies e.g., windows, doors and eaves;
- Provide educational materials regarding the environmental management of vector breeding sites used in training programs for workers to their home communities; and
- For future construction of any resettlement homes (where applicable), the following will be considered:
 - Screening: Screen windows and eaves with 16 mesh screening material and constructing flooring such that boarding that does not have cracks that permit mosquito entry (preferred method). Provide insect screen ceilings for each structure, in addition to ITNs. (Studies have shown that screen ceilings do not require treatment in order to be effective. Therefore, this can be a simple and cost-effective strategy.); and
 - Bed nets: Bed net utilization data are discussed in the baseline health analysis and are based on published PNG studies and preliminary data from the 2006 PNG Demographic Health Survey (DHS). In general overall bed net utilization levels are still low; hence, there is an opportunity for improvement and collaboration with local authorities and NGO programs.

Malaria and Well Construction

Any boreholes constructed by the Project should be in collaboration with National and District standards and the local Water Sanitation committee (if there is one). Boreholes should be designed according to their standards with appropriate drainage to prevent the creation of mosquito breeding sites.

Malaria and Pesticide/Larviciding

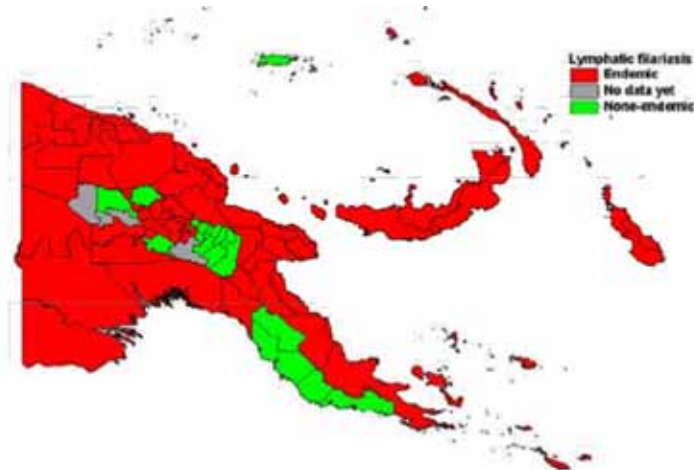
In local communities, the use of pesticide application either in the form of indoor residual spraying (IRS) or as external fogging requires careful consideration and review. Decisions regarding IRS and/or fogging should be driven by:

- The findings of entomological surveys;
- Coordination with relevant national programs;

- Stakeholder input; and
- Sustainability.

7.3.2.2 Lymphatic Filariasis (LF)

A recent assessment of the distribution of lymphatic filariasis, considered to be endemic in PNG, showed that the infection is endemic in 16 out of the 20 provinces of the country, including the National Capital District.



Source: Report of the 9th Workshop for Pacific Lymphatic Filariasis Program Managers, 2007

The mosquito born forms of filariasis that are common in PNG (Bancroftian) are caused by nematode worms which release vast numbers of tiny larvae into the blood. In PNG, anopheles mosquitoes are the dominant vector. Inadequate environmental management of surface water, especially during construction can increase anopheline breeding sites.

7.3.2.3 Dengue

The level of dengue endemicity is uncertain but grey literature data indicates that underlying population prevalence levels may range from 8-44%. Opening roadways may facilitate influx and movement of infected individuals into areas where underlying dengue endemicity levels are low. Hence, these “frontier” areas may be susceptible to sudden epidemic outbreaks. The Aedes vector is probably present across all of the Project locations.

7.3.2.4 Japanese Encephalitis (JE)

The level of JE endemicity is uncertain but published and grey literature data indicates that underlying population prevalence levels may approach 6% in some geographical areas where the Project will operate for some period of time. Opening roadways may facilitate influx and movement of infected animal (pig) reservoirs and human hosts into areas where underlying JE endemicity levels are low. Hence, these “frontier” areas may be susceptible to sudden epidemic outbreaks.

7.3.2.5 Other Arboviral Diseases

There are a large number of arboviral diseases, including Ross River and Murray Valley infections that have been documented in various parts of PNG. These diseases are difficult to diagnose clinically and are typically demonstrated by post hoc population serological studies.

Key Message

Adult mosquito surveillance is possible; however, the minimum infection rate (MIR) is typically extremely low, 1-3 per 100,000. Hence, routine adult mosquito surveillance is not a practical strategy.

7.3.2.6 Rickettsial Diseases

There have been very few studies that looked at the PNG prevalence of tick related rickettsial infections. In the Juha area, evidence of past rickettsial infection in local villages was documented. Conversely, seroprevalence studies were negative in the Gobe area. Port Moresby residents also demonstrated evidence of past infection. A potential explanation for the observed pattern of rickettsial infections in PNG appears to be related to the presence of kunai grass. The vector (mite) responsible for transmitting the infection appears to have a focused ecological niche in PNG that is associated with the presence of kunai grass. Kunai grass in the PIAs is typically not a major concern, particularly in the Southern Highlands. However, with forest clearing the possibility of kunai grass growth is possible. Therefore, the presence of a suitable ecological niche with subsequent 'colonization' via anthropogenic transport is a theoretical possibility.

Key Message

In Project areas where land clearing occurs, the re-growth of kunai grass should be prevented, thereby removing a potential habitat for vector growth. Ecological surveillance for the presence of kunai grass is appropriate.

7.4 Environmental Health Area 4: Vaccine Preventable Diseases

Vaccine Preventable Diseases – pneumococcus, measles, mumps, rubella, tetanus, typhoid, etc.

7.4.1 Issue

Project triggered influx can create potential mixing of households with variable levels of immunization for key communicable diseases. In this situation, communities can be prone to sudden epidemics of highly communicable diseases, e.g., measles, influenza, pneumococcal pneumonia, etc.

Over the past few years, government health centre staff have been taking on a greater responsibility in managing their own immunization programs, however they still require support, particularly in vaccine procurement, distribution and logistics. It is estimated that despite efforts to improve full immunization coverage, rates remain around 50% for most of the Project area. This level is below international target of 85% coverage.

7.4.2 Key Messages

- Vaccination coverage for adults and children is extremely low and makes communities prone to influx triggered epidemics.

7.4.3 Timing

Implementation of immunization programs and vaccination against disease should begin during early works and continue through operations.

7.5 Environmental Health Area 5: Soil, Water, Sanitation and Waste Related Issues

Soil, Water, Waste and Sanitation related diseases – geohelminths, e.g., giardia, hook and pin worms, etc.

7.5.1 Issue

The majority of the soil, water, sanitation and waste related impacts above background are related to the influx of job seekers and other extended family/clan members into:

- Communities surrounding the Project (LNG Site); and
- Into populated areas surrounding the Hides Gas Conditioning Plant (HGCP).

The most significant issues are:

- Water source and access (LNG Site);
- Increase in unimproved sanitation (overburdened latrines, increase in use of 'the bush', toilet facilities and excrement management); and
- Increased household waste and Project landfill waste increasing fly/sanitation related diseases (Municipal solid and liquid waste management).

7.5.2 Key Messages

The overall proposed strategy is based on:

- Controlling construction camp conditions inside the Project;
- Support to community water sanitation hygiene programs; and
- Adequate design of resettlement housing (if applicable) where significant water and sanitation enhancements are built into the housing and community level designs, e.g., water sources and latrines.

The aim of Water Environmental Sanitation (WES) projects and programs is to prevent the degradation of existing WES status in nearby communities due to Project triggered influx. Water supplies are almost universally popular but sanitation facilities are unlikely to be used and sufficiently maintained unless people want them. Sanitation has to be marketed, and this requires a very different approach from conventional civil engineering. Health improvement does not motivate many people to buy latrines, because the connection between latrine usage and health is not clearly perceived. Latrine programs combined with women's microfinance projects have been implemented recently in PNG.

The five major problems relating to excreta and sanitation which result in health risks are:

- Open defecation;
- Not washing hands properly;
- Sanitary structures not used correctly, are poorly designed, or are poorly maintained;
- Excreta is re-used as a fertilizer, fish food, building material or for fuel; and
- Contact with excreta of infected animals.

7.5.2.1 Toilet facilities and excrement management

The underlying sanitation in the Project affected communities appears to be extremely poor prior to the Project; hence, there is likely to be little or no available residual capacity that could absorb a dramatic rise in community populations – including extended family of new employees.

The benchmark, one pour flush or low volume cistern flush toilet per twenty five people served can be used to mitigate the incremental Project-related burden in the community. According to the Social Survey, PIAs do not have the 1:25 ratio however, the Project will potentially be deemed responsible for overwhelming the existing community-level infrastructure.

Overall knowledge, attitudes and practices related to sanitation are poor and many of the new internal immigrants will have a similar lack of education regarding soil/water/sanitation related illnesses and safe practices. Acknowledging this problem, other countries, (Ghana, Pakistan, Burkina Faso, etc.) have developed an extensive "Truly Clean Hands Program" targeting children and mothers with children under age 5, which could be used as a template for similar programs in the Project areas. Current evidence shows that washing hands with soap can reduce diarrhoeal diseases by 42 to 47%. In Pakistan, hand washing programs in households with children under 5 resulted in a 50% lower incidence of pneumonia than

control groups. Children younger than 15 years experienced a 53% lower incidence of diarrhoea and a 34% lower incidence of impetigo (a bacterial skin infection). Besides a strong decrease in diarrhoea prevalence, a study promoting hand washing in Indonesia also found a significantly lower prevalence of infective conjunctivitis.

7.5.2.2 Municipal solid and liquid waste management

The pre-Project community-level solid and liquid disposal system is rudimentary. Additional population influx adds an additional burden on this 'system' but the Project may be deemed responsible for perceived failures of the municipal waste infrastructure.

7.5.2.3 Body and clothes hygiene

Several pathogens can be transmitted through infectious skin or contaminated clothes. Diseases associated with fleas, mites, flies and lice are easily spread by crowded living conditions, poor personal hygiene and ineffective laundry services in work camps.

The community demands for water and sanitation services will exceed the 'true' actual impacts, particularly for water source and access improvements. Therefore, the Project must decide what level of effort to make, i.e., differentiating between impact mitigation and philanthropy. The community water/sanitation/municipal sanitation 'deficit' is so substantial that it is not possible to 'fix' this problem.

7.5.3 Timing

Influx into PIAs is occurring now; therefore, mitigation programs related to water, sanitation and waste should be developed and implemented during the design and early works phases.

7.6 Environmental Health Area 6: Food and Nutrition Related Issues

Food and nutrition related issues - changes in subsistence practices; stunting, wasting, anemia, micro-nutrient diseases (including folate, Vitamin A, iron, and iodine), gastroenteritis (bacterial and viral); food inflation.

7.6.1 Issues

There are four main issues surrounding Project impacts on food and nutrition:

- Potential transmission of food related illnesses from the Project to the surrounding communities;
- Understand the risk of food related illness transmission from the community to the Project;
- Food inflation will occur in the PIAs and may disproportionately affect vulnerable groups; and
- Understand nutritional status of key vulnerable groups in local communities.

7.6.2 Key Messages

7.6.2.1 Nutrition Survey Systems

Anthropometric measurement (physical dimensions and gross composition of the body) of children (under age 5) and adults is a safe and non-invasive method of obtaining important data regarding nutrition status across PIAs and for specific sub-populations, e.g., potential vulnerable groups. Physical measurement techniques can be supplemented with field assessment of haemoglobin levels using simple equipment that requires finger stick quantities of blood. These nutritional surveys should be expanded and performed at least twice a year, particularly for all potential vulnerable populations. Nutritional surveys are a standard function performed by a DSS.

7.6.3 Timing

In-camp kitchen programs should be initiated immediately. Community educational efforts have a longer timing horizon. Food inflation surveys should be on-going. Nutritional surveillance systems should be developed and are an intermediate range activity with the exception of monitoring existing vulnerable groups.

7.7 **Environmental Health Area 7: Accidents and Injuries; Community Safety**

Accidents/injuries and Community Safety— road traffic related spills and releases, construction and drowning.

7.7.1 Issue

Work zone accident/safety injuries and programs are covered by internal protocols and are not considered within this section. Hence, slips, falls, physical, chemical or biological (e.g., snakebites, water hazards, etc.) exposures are not considered within this chapter.

Community accident control, e.g., household accidents/injuries including fire, trauma, electrical events, is not considered to be part of this section since the Project is not directly impacting these events. This does not mean that community injury prevention and control programs are not important; however, they should be considered within a broader program of discretionary community outreach and philanthropy.

Transport activities have potential to cause direct injuries and road traffic accidents in PNG are already a significant issue and, in urban areas where there is some statistical data, a major contributor to the overall burden of disease. The existing road traffic accident burden in upstream areas is poorly quantified. In addition, there are often very high underlying rates of household level injuries and accidents, e.g., burns, slip/falls, and drowning. Dramatic upsurges in local populations can accentuate these trends and overwhelm an existing fragile medical system.

Large projects like PNG LNG will trigger a rapid improvement and expansion in the local and regional transportation infrastructure. Survey results in the upstream areas consistently demonstrate (with some exceptions from Kikori residents due to security concerns) that road and transportation improvements are highly desired by local residents.

Overall, as noted by the Asian Development Bank (ADB) in 2006: *“The people of the project area regard it as axiomatic that roads are a good thing because they increase the quality of people’s life by encouraging mobility, creating new economic opportunities, opening access to markets, and enabling access to services”* (ADB, 2006 “Report of the supplementary social impact assessment of road development in the project area²”). However, during this “transportation transition” there is a period of vulnerability to the local medical support system, e.g., trauma response and management, and to the health of local communities due to the improved ease in which communicable diseases can be introduced.

General parameters of concern are:

- Volume of traffic (function of commercial and other vehicles (cars/trucks/buses/bicycles) and pedestrians on the road);
- The road conditions themselves (sealed, poor shoulders, potholes, winding conditions, hilly conditions, width, etc.); and
- The nature of activities on the side of the road (degree of commercial activity including agricultural produce selling).

² This report was based on field research by Dr Linus Digim'Rina, ADB consultant social impact assessment specialist. Additional research was done by Penelope Schoeffel, ADB Gas Project Social Specialist, who prepared the report in consultation with Michiko Suga, Social Specialist, Pacific Department, ADB.

Goods transported were broken into three types: normal goods; out of gauge goods; and hazardous materials.

There are a large variety of potential accident scenarios and conditions that could occur with collateral impacts involving local communities, environmental effects and/or infrastructure damage.

7.7.1.1 Transport

Mitigation measures outlined in the Traffic Management Plan regarding transport activities and behavior will address:

- **Driver competency**
Drivers typically undergo internal training. Experience at OSL indicates that clan members in the HGCP area will complete the training and occasionally then send a family member to the Project to drive in their place.
- **Enforcement**
The volume of traffic and level of enforcement across rural PNG appears to be minimal.
- **Speed**
Currently, most villages in the Highlands have minimal levels of traffic. The Highlands highway is a significant exception. Speed control appears minimal along existing highways. The situation in the LNG site area is more complex due to proximity to the National Capital District (Port Moresby). At present, the highway connecting Moresby to the LNG site is already heavily utilized. Local vehicles (cars/light trucks) are frequently observed to be travelling at speeds significantly greater than posted limits.
- **Alcohol**
Given the low level of highway/traffic enforcement, it is not surprising that there is no consistent system that enforces highway alcohol testing in country. Based on experience in other developing countries, it should be anticipated that a high portion of accidents are probably alcohol related. In general, published data in the literature confirms that alcohol is a critical factor in long-haul truck accident events.
- **Vehicle Conditions**
It is unclear if there are uniform and enforced vehicle maintenance standards or frequency of testing required, e.g., tire wear, placarding and signage, mirrors, physically securing loads/containers, etc.
- **Fatigue**
In the developing world trucking industry, there is a dangerous combination of:
 - A push for extra hours;
 - No regulatory enforcement;
 - No written legislation; and
 - A very competitive, primarily unregulated transportation industry that is in an environment of increasing opportunity.
 - No legislation prohibiting travel at night was noted in Governmental documents. The Project typically prohibits night-time travel for activities directly supervised by the Project.

- Security

There is a high probability of theft from general stores and likely a moderate risk for hazardous materials exposure. The contributing factors to this risk are associated with a lack of governance, high poverty rate and unemployment. Security issues such as robbery and assault increase in market areas and significantly at night.

- Medical Support

In the relevant Project areas, medical support is limited to major provincial centers such as Moresby Mendi and Mt. Hagen. The few clinics that are along the routes are equipped, staffed and trained to a level that would be inadequate for any significant road trauma event. Also, there is no reliable ambulance service with the possible exception of the Moresby area.

- Community Conditions

Vehicles passing through or near communities will encounter high pedestrian traffic, congestion and narrowing of roadways. In the event of an incident, the population will have a tendency to swarm the area and become extremely agitated. Life and property could be at an extreme risk should the crowd deem the accident in any way personal.

- Additional Items

Agriculture\vegetation grows right to the shoulder of many roadways. In the event of a hazmat spill, these areas have a very high likelihood of being damaged. This problem is compounded when considering both the 'rainy season' and should a spill occur into a river especially when commuting over a bridge.

7.7.2 Key Messages

Key messages include:

- There is a lack of roadway signage in all Project areas;
- Accident prevention programs at a community level are not in place;
- Law enforcement for (speeding, reckless driving, alcohol use, seat belt usage, use of mobile phones while driving etc.) is minimal;
- Medical emergency response systems for off-site accidents, injuries or hazardous materials release events does not exist;
- Changes to road conditions, road access, river access, electricity and power supplies, water supply & distribution, telecommunications is addressed in the Community Infrastructure Plan;
- Traffic related issues are addressed in the Traffic Management Plan;
- Community interaction with site-related potentially hazardous materials is addressed in the Community Impact Plan;
- Site physical water structures such as fire water ponds are attractants for people and animals;
- Community household injury prevention and control should be considered as a separate outreach activity. District statistics indicate that household level accidents/injuries are a significant source of morbidity and mortality and are consistently in the "Top Ten" causes of hospital admission; and
- Within the work zone accident/injury prevention, control and management is a major function of the SHE Department and is not directly covered in this analysis. Obviously if there are major deficiencies in these programs there

can be impacts from on-site events that potentially extend into the community. While this possibility is considered and should be continually evaluated, there are sufficient in-house systems that monitor this issue, e.g., routine safety and medical audits, internal audits, etc.

7.7.3 Timing

There is an immediate need to implement the management strategies listed in Attachment 2.

7.8 **Environmental Health Area 8: Social Determinants of Health; Community Security**

Social Determinants of Health (SDH): psychosocial, resettlement/relocation, violence, security concerns, substance misuse (drug (including betel nut), alcohol, smoking), depression and changes to social cohesion

7.8.1 Issues

PIA communities have some underlying level of drug and alcohol use, smoking, and gender violence. In addition, local social cohesion, or lack thereof (crime and security fears), is present to some degree. Community concerns related to security and violence are significant and in many locations (e.g., LNG site) are rated as the highest worry by survey respondents. Project triggered influx is a general stressor to the community and typically accentuates fissures and pathologies that may already be present. The opening of roadways will create internal in-migration with influx of different cultural groups, creating social disruption. Cross-cultural clashes can occur inside the fence if cultural groups are mixed that have a history of conflict.

There will be an influx of personnel and job seekers into the Project Impact Area, particularly the LNG site area. This has the potential to disrupt social cohesion and stress communities due to the mixing of cultures and competition for limited resources and economic opportunities. This also has the potential to increase law and order issues, e.g., clan conflict, assault, theft, and damage to property, etc.

DSS based surveys will capture the changes in key social determinants. Rapid influx can produce short and long term impacts, positive and negative within local communities. The health ramifications of these changes are direct, indirect and potentially cumulative in nature.

Community security can be assessed at two levels: internal, where community issues can affect social cohesion; and external factors that present threats to communities. Finally, the use of excessive force or inappropriate conduct by public or private security forces protecting The Project's personnel and assets may result in adverse effects and consequences to individuals and communities.

7.8.2 Key Messages

Key messages are:

- Mixing of cultural groups in communities and work zones may create conflict;
- Increases in substance abuse and gambling are important concerns in the PIAs;
- Gender violence is an important issue related to influx and dramatic changes in income;
- Changes in income result in increased substance abuse and gambling;
- Rising incomes and influx will attract a variety of service providers both positive and negative; and
- The safety and security of the Project operations is an important focus while ensuring respect for human rights.

7.8.3 Timing

There is an immediate need to implement the management strategies listed in Attachment 2.

7.9 **Environmental Health Area 9: Hazardous Materials Exposure**

Exposure to potentially hazardous materials: road dusts, air pollution (indoor and outdoor related to industrial activity, vehicles, cooking, heating or other forms of combustion/incineration), landfill refuse or incineration ash, any other Project related solvents, paints, oils or cleaning agents, by-products, noise and illumination.

7.9.1 Issue

Hazardous materials issues are related to the following:

- Accidental releases of on-site materials that could affect nearby communities, e.g., diesel fuel, sewage effluent, insecticides;
- Air emissions from plant operations, particularly related to diesel emissions from power generating equipment;
- Transportation related leaks/spills. These events are covered under accidents and injuries;
- “Poison Centre” concerns: exposures of workers to pesticides; exposures to pesticides and fecal coliforms via food residues; and snakebites and other envenomation events in communities; and
- Risk communication in local communities related to hazardous materials and also feedback of sampling results, e.g., water, soil and air monitoring.

7.9.2 Key Messages

Key messages are:

- Air, groundwater and surface water releases are community concerns;
- Snake migration may occur during civil construction activities; and
- Timely risk communication dialog with the community is an important function.

7.9.3 Timing

Implementation of the measures described in Attachment 2 will remain ongoing throughout construction and operations.

7.10 **Environmental Health Area 10: Respiratory/ Housing**

Housing and Respiratory issues: acute respiratory infections (bacterial and viral), pneumonias, tuberculosis; respiratory effects from housing, overcrowding, housing inflation.

7.10.1 Issues

Many respiratory diseases are highly communicable and could be transmitted back and forth between the community and a large onsite workforce, particularly during the construction phase.

The key goals are:

- Prevent rapid rise and further transmission (worksite and community) of communicable respiratory diseases in workforce populations, particularly onsite construction workers in temporary barrack-style housing;
- Prevent rapid rise and further transmission of communicable respiratory diseases in resettlement households;

- Prevent introduction of communicable respiratory diseases via Other Country Nationals (OCNs) (e.g. Filipinos, Indians, etc.) into local communities, specifically pandemic flu and tuberculosis; and
- Establish a monitoring and evaluation program for respiratory diseases.

7.10.2 Key Messages

- Primary prevention (i.e., immunizations for adults and children) is the most cost effective method of managing communicable respiratory disease impacts;
- The underlying burden of TB in the general population is extremely high and rising. Increasing rates of HIV/AIDs are likely to further magnify this problem;
- The rates of multi-drug resistant (MDR) tuberculosis are extremely high and rising. Up to 10% of newly diagnosed cases of TB are presenting as MDR;
- The laboratory diagnostic capabilities for comprehensive TB evaluation are limited;
- Latent TB rates are 30 to 40% in the general population. Approximately 5 to 10% of the latent cases will convert to active TB over a 2 year period;
- The government TB control programs are extremely weak or non-existent in the Project areas; and
- Approximately 50% of childhood deaths the age under 5 are due to vaccine preventable respiratory illnesses. Similarly, almost 30 to 40% of the adult deaths particularly for those over age 50 could be prevented by vaccination for communicable respiratory diseases.

7.10.3 Timing

Implementation of the measures described in Attachment 2 will remain ongoing throughout construction and operations.

7.11 **Environmental Health Area 11: Non-Communicable Diseases**

Non-Communicable Diseases - hypertension, diabetes, stroke, and cardiovascular disorders

7.11.1 Issues

Due to the improvement in income generation and changes in nutrition the Project is likely to trigger an epidemiologic transition from infectious to non-communicable diseases (NCD) in both the workforce and PIAs.

7.11.2 Key Messages

Key messages are:

- Review of Oil Search medical clinic databases indicates that the transition from infectious to NCDs is occurring rapidly;
- The local care service providers are not experienced and trained in NCDs.
- There are significant pharmaceutical supply and storage issues for many of the medications used for the most important NCDs, e.g., insulin and anti-hypertensives; and
- Resettlement populations also need longitudinal evaluation because transition to NCD disease burden profile can rapidly occur after compensation packages.

7.11.3 Timing

Immediate.

7.12 Environmental Health Area 12: Veterinary Medicine/ Zoonotic Diseases

Veterinary Medicine/Zoonotic Issues: potential disease distributions secondary to changes in animal migration/market selling patterns due to Project-related activities or infrastructure.

7.12.1 Issues

The relationship between domestic animals and their human keepers mean that certain diseases resident in animals can affect human populations. These include: Pigbel (caused by the bacterium *Clostridium perfringens*); *Serpulina pilosicoli* infection; *Salmonella choleraesuis*; and porcine brucellosis. The close association between pigs and people is a risk factor for diarrhoea in humans. In PNG, particularly in the highlands, the status of pigs is extremely important. Pigs act as a reservoir currency and are also used in a large number of cultural functions; hence there is extremely close interaction between pigs and their human owners.

In Port Moresby, the presence of pigs in compounds was associated with diarrhoea in children below five years of age. In the Highlands, a recent survey found rotavirus in fecal samples in children with severe diarrhoea, and a rotavirus strain was also demonstrated infecting piglets.

A number of different parasites infect pigs, the most important for humans are the tapeworm, trichinella, hydatid disease, and ticks. Water pollution from pig feces (coliform and fecal streptococci) occurs; affecting drinking water supplies. In addition, antibodies to the JE virus have been reported from pigs in West Sepik Province.

When pigs are used by the project as compensation, consideration should be given to evaluating the medical status of the pigs.

7.12.2 Key Messages

The key messages are:

- Transfer of pig related diseases to humans is well established in PNG; and
- As a consequence of improved and new roadways, movement of pigs and their associated diseases can more readily occur.

7.12.3 Timing

Veterinary diseases should be considered within any compensation program that uses animals as currency.

8.0 RESETTLEMENT POPULATIONS

8.1 Issues

Multiple potential health impacts are related to involuntary resettlement, such as access to health care, nutrition status, and movement from an area of low malaria transmission to an area of high transmission, increases in violence, etc. Resettlement issues were not a component of the 2008 HIA effort; therefore, this area will be evaluated and addressed from an impact perspective.

8.2 Key Messages

Household health status will be assessed as part of the supplementary social survey efforts that will be performed in May 2009 in the Komo area. These supplementary survey efforts have been triggered by potential resettlement considerations related to airfield and road development in between Komo and the Hides Gas Conditioning Plant.

Longitudinal follow up of resettlement populations can be performed as part of the DSS.

9.0 ROLES AND RESPONSIBILITIES

Roles, responsibilities and partnerships for implementing the plan are described by program area in Attachment 2.

10.0 MONITORING AND EVALUATION

10.1 Demographic Surveillance Systems (DSS)

Accurate and timely data allows for objective, evidence based decision making. In the biomedical and social sciences, evidence based decision making is no less critical than for engineering, procurement and construction.

The Project is an extremely high profile undertaking that will have ongoing scrutiny from an extremely diverse set of stakeholders including NGOs, multilateral institutions, international financial institutions, host government and company shareholders. While stakeholders are “free” to develop and hold their own opinions, these beliefs should be based on a transparent, coherent, and objective set of data. While the Project cannot control beliefs, it can manage data collection by using a scientific and defensible process that is best practice in a developing country setting.

The most widely accepted and used system for cost-effectively obtaining and managing key social and biomedical data is the Demographic Surveillance System (DSS) sponsored by the INDEPTH Network.

INDEPTH is the umbrella organization for an international network of field sites that continuously evaluates key social and biomedical indicators in developing countries. The INDEPTH network currently consists of 33 demographic surveillance systems (DSS) field sites in 19 countries that collectively monitor 2,200,000 people at a household-level. This monitoring system provides a platform for the design and evaluation of a wide range of health, social, economic, behavioral and health issues that are relevant to a resource constrained country that does not have adequate national level vital statistics services. PNG has a DSS site that is operated by the PNG Institute for Medical Research (PNGIMR); hence, there is good experience within PNG for DSS and its benefits to key national policy decisions, e.g., malaria control.

In the developing country context, a hall mark of the high burden of treatable disease is the lack of a reliable information base to support the identification, assessment and cost-effective prevention and treatment of disease and associated social issues. For a large infrastructure project like PNG LNG, it is critical that an ongoing objective pre-project baseline be established and continuously monitored.

In ongoing work presented at the 2009 Extractive Industry Transparency Initiative (EITI), the World Bank presented preliminary data from a large retrospective study of the effectiveness of the environmental/social impact assessment process. The initial results of this study indicate that while the initial impact statements were generally well done, the follow-through monitoring was consistently weak and ineffective. The Bank presenters clearly felt that greater efforts needed to be placed on the longitudinal monitoring system.

Without an adequate longitudinal monitoring and evaluation process there is no way to demonstrate the effectiveness of mitigation activities.

DSS is the most cost-effective, transparent and objective process of obtaining the data the Project will need to demonstrate that:

- Mitigation efforts have been successful;
- Negative impacts are not occurring; and
- Cumulative positive benefits from the Project are accruing.

Without a DSS process, the Project will perform a series of very costly and “one off” series of community surveys that will be attempts to respond to:

- Claims and accusations of negative impacts by various stakeholders;
- Data requests generated by international financial institutions and their external compliance groups;
- Host government queries;
- Internal Project constituents, e.g., Public Affairs, Community Relations, senior management, etc.

Without a transparent and objective process, the Project will be in a perpetual reactive mode and always behind the “data/information curve.” This pattern is endlessly seen in large high profile projects and is well documented by the World Bank in their recent research on the effectiveness of impact assessments.

The DSS process allows the Project a method of collecting the data in a cost-effective, transparent, objective and scientific manner. The INDEPTH network has stringent rules governing data collection and access to information. This prevents unauthorized and inappropriate “data mining” by agenda-driven individuals or groups.

The DSS process keeps the Project in the favorable “one-degree of separation” position from the data collection effort, the local communities and the custody of sensitive household level data. DSS functions by have a lead research institution, i.e., the PNGIMR, act as the overall DSS manager. PNGIMR is successfully performing this role at the Madang site. PNGIMR is a member of INDEPTH and operated under their rules and procedures. External scientific groups, e.g., Swiss Tropical Institute, perform scientific oversight and help disseminate information through peer-reviewed scientific journals.

DSS will cost-effectively collect baseline data to fill existing data gaps and produce objective longitudinal information that will demonstrate whether the Project is meeting its commitments to key stakeholders.

The Project is going to collect data and respond to various information demands. The key decision is whether this monitoring and evaluation (M&E) effort will be performed cost-effectively and systematically or whether it will be ad hoc, reactive and expensive. DSS affords the Project a way to meet multiple objectives:

- Evidence/science based analysis and decision making;
- Transparency but one degree of separation from the on the ground effort; and
- Sustainability and capacity building particularly enhancing national content objectives as local hiring is a hallmark of DSS.

The technical details of the DSS process are presented in Attachment 2 of this document.

11.0 REPORTING AND NOTIFICATION

The Project Community Health and Safety Manager will work with the Project Team and other Social Programs representatives to develop procedures for reporting community health and safety program evaluations, results of demographic surveillance system activities, and responses to community health and safety related grievances.

12.0 REFERENCES

- [Http://www.indepth_network.net](http://www.indepth_network.net)
- International Finance Corporation. Introduction to Health Impact Assessment, 2009
- IPIECA. Guide to Health Impact Assessment for the Oil and Gas Industry, 2005.
- IFC Good Practice Notes to Performance Standard 4.

Esso Highlands Limited



Papua New Guinea LNG Project

Appendix 24: Company Community Health, Safety and Security Management Plan Attachments

Attachment 1: Relationship between: (1) Project Health Plan, (2) Community Health and Safety Plan, (3) Community Health and Security Management Plan and (4) Community Impacts Plan

Attachment 2: Community Health, Safety and Security Management Plan – Strategic Framework

Attachment 3: PNG Demographic Surveillance Systems (DSS)

ATTACHMENT 1: RELATIONSHIP BETWEEN: (1) PROJECT HEALTH PLAN (2) COMMUNITY HEALTH AND SAFETY PLAN (3) COMMUNITY HEALTH SAFETY AND SECURITY MANAGEMENT PLAN (4) COMMUNITY IMPACTS PLAN

	Project Health Plan	Community Health and Safety Plan	Community Health Safety and Security Management Plan	Community Impacts
Implementing Party	The Company	Contractor (via Contractor Implementation Plans)	The Company	Contractor (via Contractor Implementation Plans)
Inside / outside the fence	Both	Outside	Both	Outside
Scope	<p>Primarily intended for an internal PNG LNG audience and accordingly addresses internal health objectives.</p> <p>Describes the processes and procedures that will be applied to achieve the internal occupational (worker) health related objectives, including resources and responsible organizations.</p>	<p>Focuses on Contractor/ community interface, the potential health impacts that may arise from this interaction and corresponding mitigation measures.</p> <p>While most of the actions described in this plan are also described in the (the Company) Community Health Safety & Security Plan, the intent is to specifically describe expectations and responsibilities of the Contractors.</p> <p>To be used by Contractors as a basis for preparing their Contractor Implementation Plans.</p>	<p>Specifically focuses on the mitigation of potential community health impacts that may be attributed to the Project and its workforce, and that are considered to be the responsibility of the Company.</p> <p>Unlike the Contractor Community H&S MP the scope is not confined to Project work sites (e.g., it includes H&S issues associated with Camps.</p> <p>There are many actions that relate back to compliance with the Project Health Plan addressing workers, as there are clear associations with disease transmission from the workers to the communities and from the communities back to the workplace. This Plan is not intended to focus on community health investment initiatives, however mitigation measures addressed in this Plan (Attachment A) will be coordinated with the strategic community investment initiatives.</p>	<p>Deals with potential impacts on individuals and communities caused as a result of Contractor construction activities.</p> <p>Includes, but is not limited to community health and safety issues (e.g., construction-related traffic).</p>

ATTACHMENT 2: COMMUNITY HEALTH, SAFETY AND SECURITY MANAGEMENT PLAN – STRATEGIC FRAMEWORK

Impact Timing

EW – Early Works

C – Construction

O – Operations

PIAs

- Juha
- HGCP Area (Hides, Kobalu, Komo, Malanda, Nogoli, Yuni, Angore, Denaria, Tari)
- Homa to Kantobo
- Gobe to Kikori/Omati (Base Camp and Port area)
- Portion 152 (Lae Lae, Papa, Boera, Porebada)
- Ring Road (Lae to HGCP)

Acronyms

ADB – Asian Development Bank

AO – Ability to Operate

CBHC – Community Based Health Care

CHIMP – Community Health Impact Management Plan

CO – Company

Comp – Compliance

CT – Contractor

ECPNG – Evangelical Church of PNG

EMHP – The Company's Health Policy

EMS – Emergency Medical Services

EnvAct – Environmental Act 2000, Section 58, PNG

EAG – The Company's Environmental Aspects Guide

EPC – Engineering procurement Construction

Freq. – Frequency

GCS – Gulf Christian Services

GoPNG – Government of Papua New Guinea

HAMP – HIV AIDS Management and Prevention Act

HIV – Human Immunodeficiency Virus

HMS – Hyper-reactive malaria splenomegaly

ILG – Independent Landowner Groups

ITT – Invitation To Tender

LF – Lymphatic Filariasis

Mon – Monitoring

NCD – Non Communicable Disease

NHM – Nazarene Health Ministries

PDS – Project Design Specifications

PIAs – Potentially Impacted Areas

POM – Port Moresby

PSI – Population Services International

STI – Sexually Transmitted Infection

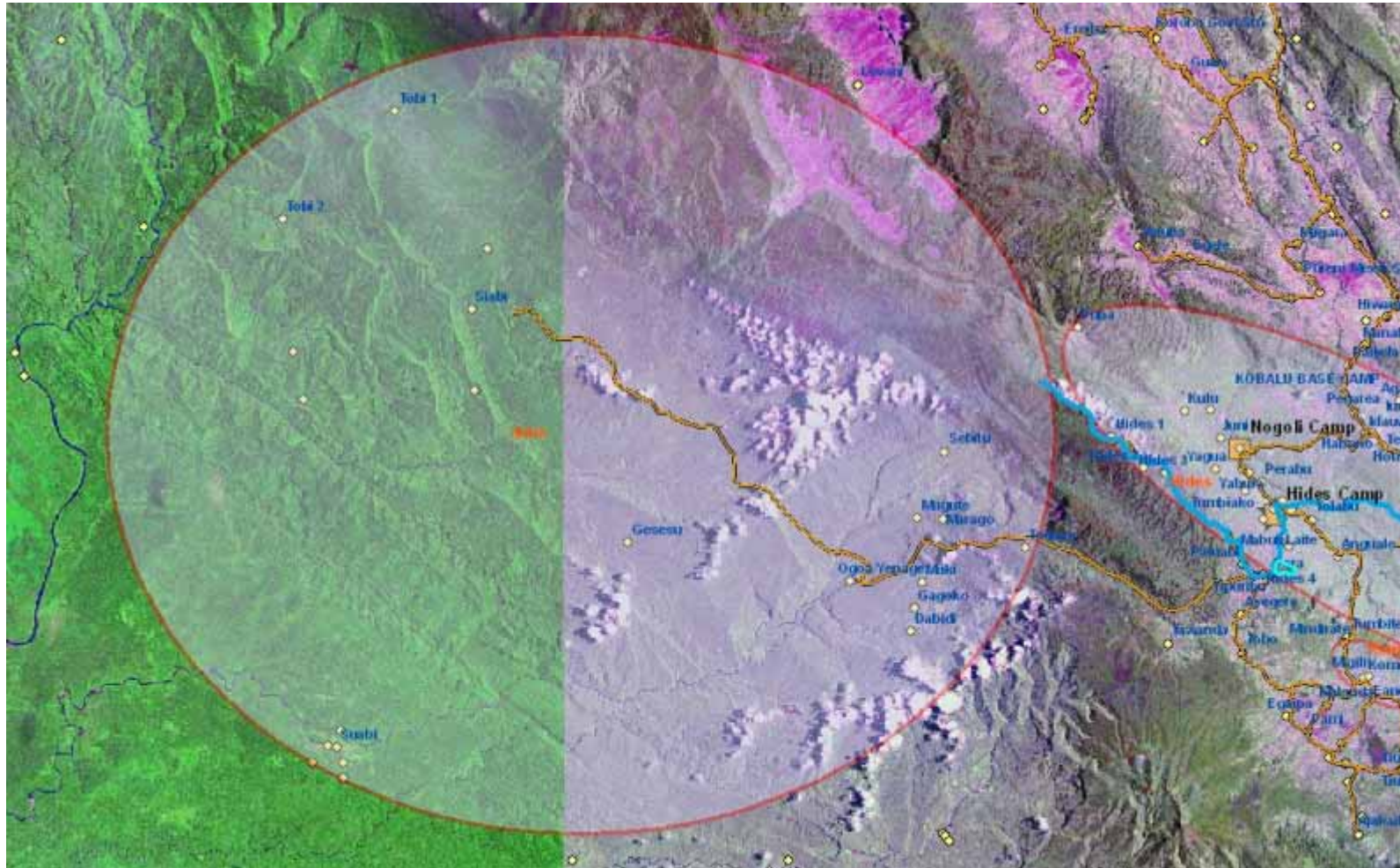
STP(s) – Sewage Treatment Plant(s)

VCT – Voluntary Counseling and Testing

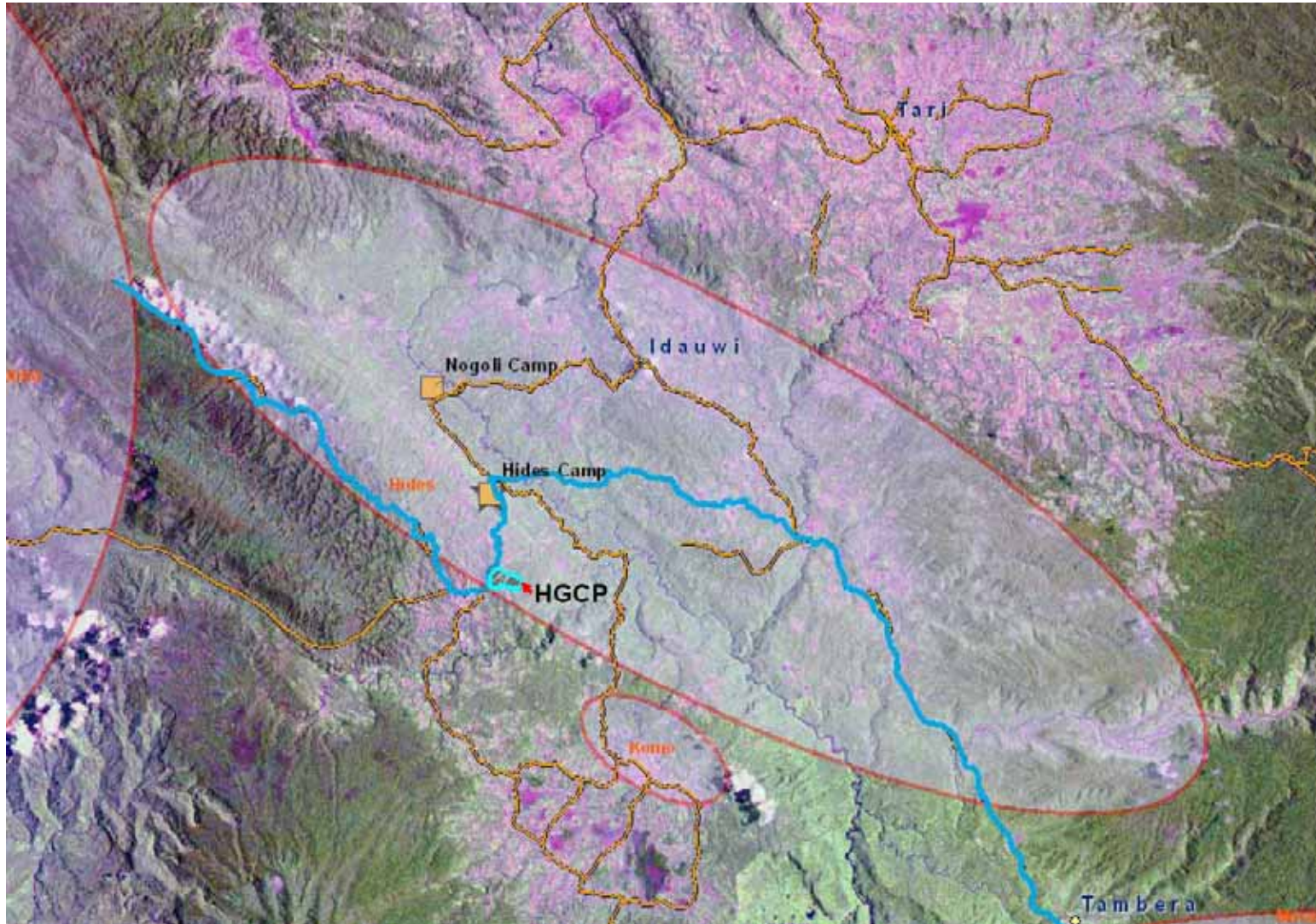
W – With

Potentially Impacted Areas are separated by geography and somewhat by social/cultural differences. These general geographic areas are shown in the figures below.

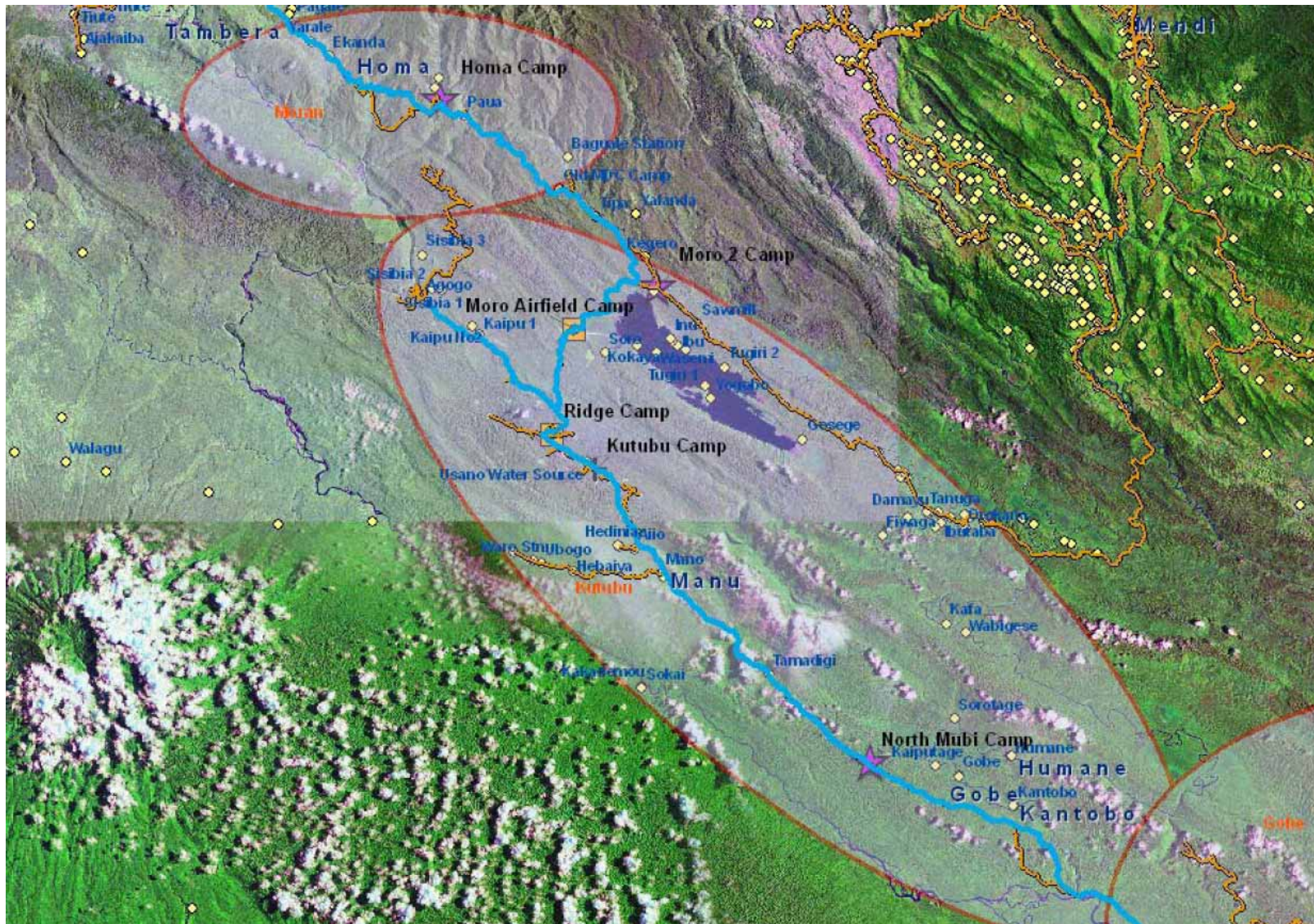
Juha



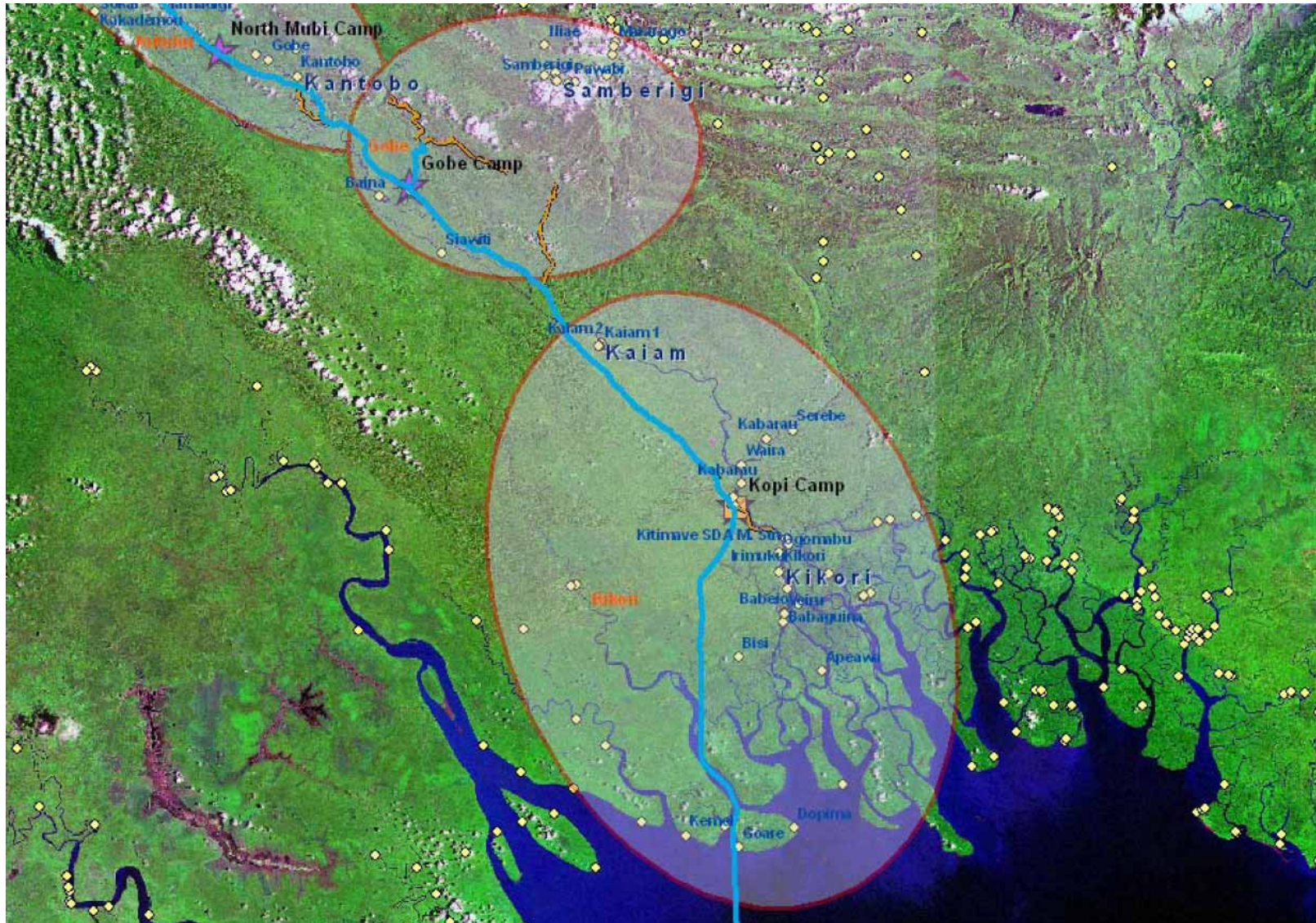
Hides Gas Conditioning Plant (HGCP) area (Hides, Kobalu, Komo, Malanda, Nogoli, Yuni, Angore, Denaria, Tari)



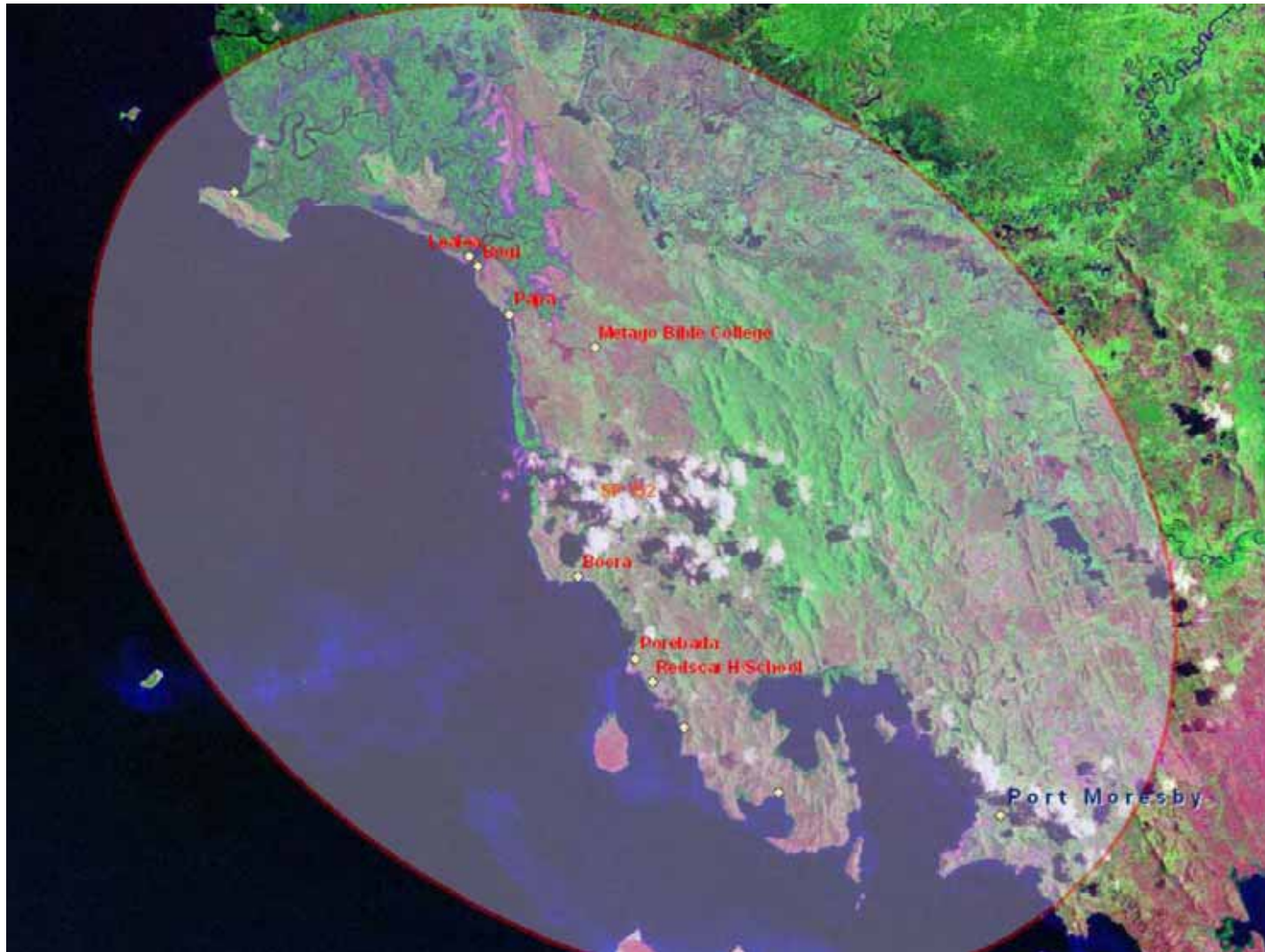
Homa to Kantobo



Gobe to Kikori/ Omati (Base Camp and Port area)



Portion 152 (Laelae, Papa, Boera, Porebada)



Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R in g R	H o m a	K ik o ri	P 15 2	Mitigation strategies	H G C P	J u h a	R in g R	H o m a	K ik o ri	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitor- ing frequency	Respon- sibility - Partner
Health Services Infrastructure, Capacity	1.1	Significant influx of individuals seeking employment opportunities and required services will need to include health services. (Company procedures typically do not provide for treatment of community populations).	C-O	-	C	C	C	C-O	Provide support for the development of a District Health Centre/triage capacity, and assist to provide capacity to transport patients.	C-O	-	-	-	-	C-O	6 months before work starts	Structural: Physical & functioning presence of a service delivery mechanism and staff. Structural: Presence of functional transport services.	Annual	Company, Provincial govt. Partner CMS, ECPNG
	1.2	National employees have expectations for medical treatment of family members.	C-O	C	C	C	C	C-O	Enhance Aid Post capacity and services Hides area and LNG area.	C-O	-	C	C	C	C-O	6 months before work starts	Outcome: outpatient utilization of local aid post.	Q 6 months	Company, Provincial govt Partner CMS, ECPNG, PSI
	1.3	Influx related health care demands cannot be met by existing local capacity.	C-O	-	C	C	C	C-O	Support ECPNG (Malanda) sub center to expand to Komo area as needed	C-O	-	-	-	-	-	6 months before work starts	Outcome: number of visits to OPD; satisfaction of care surveys. Process: staffing levels.	Q 6 months	Company Provincial govt Partner ECPNG

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R in g R	H o m a	K ik o a	P 15 2	Mitigation strategies	H G C P	J u h a	R in g R	H o m a	K ik o a	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
	1.3a								Consider supporting the Community Based Health Care Workers in key communities. Ensure the District Health Center has the capacity to oversee Community Based Health Care program (CBHC).	C - O	C	C	C	C	C - O	6 months before work starts	Structural: Number of trained community health workers; Verification by audit.	Q 6 months	Company Provincial govt Partner ECPNG, NHM
	1.3b								Consider facilitating the staffing of community health programs development and management.	C - O	C	C	C	C	C - O	6 months before work starts	Process: Number of days/FTEs allocated.	Annual	Company
	1.3c								Consider facilitating service and staff build-up at Area Hospital/Health Center either through fixed or mobile approaches.	C - O	-	-	-	-	C - O	6 months before work starts	Structural/ Process: Verification of support services provided at Hides area and Kikori hospital catchment areas.	Quarterly	Company Provincial govt Partner TBD

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g R	H o m a	K i k o r	P 15 2	Mitigation strategies	H G C P	J u h a	R i n g R	H o m a	K i k o r	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
	1.3d								Provide scholarships to local students for health care training to support staffing of Aid Posts, CBHC and Health Centers. Provide support for long term staffing of health facilities and services, including housing and ongoing training and supervision.	C - O	-	-	-	-	C - O	Now	Process; Number of scholarships provided, number of staff supported; number of housing facilities supported.	Q 6 months	Company Partner CMS, ECPNG
	1.4	Perception of inequity in hiring practices based on existing health conditions can trigger community unrest.	C- O	C	C	C	C	C- O	Provide to all contract companies (local lancos and EPCs) the specifications for performance of fitness for duty exams.	C - O	C	C	C	C	C - O	Now	Verification Compliance with Project requirements.	Quarterly	Company Lancos, Contractor
	1.5	Fitness for Duty medical requirements have consequences for follow up and treatment that cannot be delivered locally, e.g., tuberculosis, hypersplenomegaly (enlarged spleen), periorbital abscess.	C- O	C	C	C	C	C- O	Identify service provider for follow up treatment of issues identified in fitness for duty exams.	C - O	C	C	C	C	C - O	Now	Process: number of referrals for follow up treatment.	Q 6 months	Company Contractor
	1.6	Influx migrants and existing community members will expect and	C- O	-	C	C	C	C- O	Identify a partner to provide EMS for community members.	C - O	-	C	C	C	C - O	Now	Process; Number and type of	Monthly	Company Partner OSL, TBD

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g R	H o m a	K i k o a	P 15 2	Mitigation strategies	H G C P	J u h a	R i n g R	H o m a	K i k o a	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
		demand emergency medical evacuation services, because all other companies in the Highlands region provide this service (OSL, Porgera).															transports.		
	1.6a								Enhance services at Hides area reducing the need for air transport (see 1.6).	C - O	-	C	-	-	-	2Q09	Process: Comparison of transports before and after intervention.	Q 6 months	Company Partner TBD
	1.6b								Enhance services at Kikori hospital reducing need for air transport to POM.	-	-	-	-	C	-	2Q09	Process: Comparison of transports before and after intervention.	Q 6 months	Company Partner GCS
National Program Management Delivery Systems (TB)	2.1	Periodic TB screening process with Quantiferon will identify TB cases (active and latent) that require follow up diagnostics and possible treatment; which is non-existent in the Project area.	C- O	C	C	C	C	C- O	Support national TB control program and partnership in providing TB prevention and control services in the Project area.	C - O	C	C	C	C	C - O	2Q09	Verification	Q 6 months	Company Partner PNGIMR
National Program Management Delivery Systems	3.1	Influx, and new roadways will facilitate movement of infected individuals	C- O	-	C	C	C	C- O	Establish STI/HIV control program in the Project area Enhance STI/HIV control program efforts in the	C - O	C	C	C	C	C - O	Early Works	Verification of DSS performance.	Quarterly	Company Partner PNGIMR, PSI

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g R	H o m a	K i k o r	P 15 2	Mitigation strategies	H G C P	J u h a	R i n g R	H o m a	K i k o r	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
(STIs, HIV/AIDS)		into the area, currently no nationally run program exists.							Project area to include treatment of curable and controllable STIs, education, VCT, condom and femdom distribution. Use CBHC, Aid Posts and PNGIMR to support strategy.										
STIs, HIV/AIDS related diseases	4.1	Work camp personnel will provide opportunities for increases in STIs, HIV/AIDS (workers entering and leaving the worksite will attract service and sex workers creating the conditions for a surge in STIs).	E W - O	C	C	C	C	C-O	Implement, monitor and verify strict camp security procedures (closed camps).	C - O	C	C	C	C	C - O	EW	Verification	Ongoing	Company Contractor
	4.1a		C-O	C	C	C	C	C-O	Find and treat all curable STIs in Project workers; refer controllable (HIV & herpes) STIs to VCT centre.	C - O	C	C	C	C	C - O	EW	Verification	Yearly	Company Contractor Partner PNGIMR
	4.1b		C-O	C	C	C	C	C-O	Conduct worker education programs for STIs, HIV/AIDS.	C - O	C	C	C	C	C - O	EW	Verification	Yearly	Company Contractor
	4.1c		C-O	C	C	C	C	C-O	Implement voluntary counseling on site and referral testing for HIV.	C - O	C	C	C	C	C - O	EW	Verification	Yearly	Company Contractor Partner PNGIMR

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g R	H o m a	K i k o r	P 15 2	Mitigation strategies	H G C P	J u h a	R i n g R	H o m a	K i k o r	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitor- ing frequency	Respon- sibility - Partner
	4.1d		C-O	C	C	C	C	C-O	Distribute condoms and femidoms to workers.	C-O	C	C	C	C	C-O	EW	Verification	Yearly	Company Contractor
	4.1e		C-O	-	C	C	C	C-O	Provide transportation to local commuting workers from work site to home to limit local sex worker contact.	C-O	-	C	C	C	C-O	EW	Verification	Q 6 months	Company Contractor
	4.1f		C-O	C	C	C	C	C-O	Provide support for the development of women's clubs and support groups (possibly integrate with CBHC activities).	C-O	C	C	C	C	C-O	EW	Verification	Yearly	Company Partner TBD
Vector Related; Malaria	5.1	Geographic areas that currently have very low transmission rates due to industry based program efforts may experience increases in transmission rates due to influx of infected individuals from other areas.	C-O	-	C	C	C	C-O	OSL Continue community based malaria control (indoor residual spraying, early diagnosis and treatment and case finding) activities in existing areas of program activities.	C-O	-	C	C	C	C-O	EW	Outcome: zero prevalence surveys.	Quarterly	Company Partner OSL initially then GoPNG & PNGIMR
	5.2	If drinking water sources are enhanced in PIAs by the Project, the potential exists to create mosquito breeding sites.	C-O	-	C	C	C	C-O	Construct Project related boreholes or water sources in collaboration with RWSSP requirements and standards to include appropriate drainage to prevent	C-O	C	C	C	C	C-O	EW	Verification Larval surveys.	Annual	The Company Provincial government Partner EU

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g R	H o m a	K i k o a	P 15 2	Mitigation strategies	H G C P	J u h a	R i n g R	H o m a	K i k o a	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
									mosquito breeding sites.										RWSSP, CARE, ADRA
	5.2a		C-O	-	C	C	C	C-O	Coordinate inside the gate vector control insecticide use with existing insecticides used in community based programs. Conduct insecticide resistance testing.	C-O	C	C	C	C	C-O	3Q09	Verification Outcome: insecticide resistance testing.	Q 6 months	Company Contractor Partner PNGIMR
			C-O	C	C	C	C	C-O	Provide bed nets to workers for take home use.	C-O	C	C	C	C	C-O		Verification		
			C-O	C	C	C	C	C-O	Educate workers regarding vector related disease transmission.	C-O	C	C	C	C	C-O				
Vector Related Lymphatic Filariasis (LF)	6.1	Population influx creating increases in unimproved sanitation, thereby increasing LF disease transmission by mosquito vectors.	C-O	-	C	C	C	C-O	(See Sanitation/ Waste discussion in document), Provide support to develop community latrine program as needed.	C-O	-	C	C	C	C-O	3Q09	Verification	Annual	Company Partner EU RWSSP, CARE ADRA
	6.1a		C-O	-	C	C	C	C-O	Provide support to implement a polystyrene beads public/private latrine program for the control of nuisance mosquitoes as needed.	C-O	-	C	C	C	C-O	4Q09	Verification	Q 6 months	Company EU RWSSP, CARE ADRA (partner)

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g R	H o m a	K i k o r	P 15 2	Mitigation strategies	H G C P	J u h a	R i n g R	H o m a	K i k o r	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
Vector Related: Dengue	7.1	Opening of roadways facilitating movement of infected individuals into the area; endemic in the coastal areas. (contingent upon dengue prevalence differences between high and low prevalence groups).	C-O	-	C	C	C	C-O	Project container management program; dengue management program with case definitions, diagnostics, etc.	C-O	-	C	C	C	C-O	Construction	Verification: container larval surveys.	Weekly	Company Contractor Partner STI PNGIMR
									Educate local HS providers, local chiefs, council, and church regarding container management strategies to prevent the creation of breeding sites.	C-O	C	C	C	C	C-O	Construction	Process: number of training sessions provided. Verification: container larval surveys.	Quarterly	Company Partner STI PNGIMR
									Educate local HS providers – provide pictorial materials used in worker education to local HS providers.	C-O	C	C	C	C	C-O	Construction	Verification	Yearly	Company
Vaccine Preventable Diseases	8.1	Potential increase in measles, mumps, rubella, chicken pox, pneumococcal pneumonia, influenza, typhoid, outbreaks in the	EW-O	EW-O	EW-O	EW-O	EW-O	EW-O	Provide support for community based vaccination programs in Project areas. Support existing efforts and expand program to all PIAs. Integrate with mobile	C-O	C	C	C	C	C-O	4Q09	Verification Outcome: Immunization rates of workers.	Quarterly Ongoing	Company Contractor Partner PSI,

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g a	H o m e a	K o m m u n i t y	P o p u l a t i o n	Mitigation strategies	H G C P	J u h a	R i n g a	H o m e a	K o m m u n i t y	P o p u l a t i o n	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
		community related to population influx; or the introduction of personnel who are not immunized - workers travelling to Juha will be required to have proof of immunity as a condition of travel to Juha.							community efforts and Aid Post/Health Center support. Workers.										PNGIMR
									Offer immunization program "inside the fence" for Project workers (comply with Project requirements).	C - O	C	C	C	C	C - O	EW	Verification Outcome: Immunization rates.	Quarterly	Company Contractor
EHA Water, Sanitation & Waste Related Diseases	9.1	Project Sewage Treatment Plant (STP) overflowing into area surface drinking and bathing water sources; increasing fecal-oral diseases.	E W - O	E W - C	E W - C	E W - C	E W - C	E W - O	Operate and monitor STPs according to designed capacity. Provide surge capacity and monitoring of the system.	C - O	C	C	C	C	C - O	EW	Verification Outcome: STP overflow; malfunction.	Annual	Company Contractor
	9.2	Project water use could potentially deplete community drinking, bathing and laundry water supplies, increasing water related diseases.	C - O	?	-	C	C	C - O	Monitor Project water related impacts according to EMP.	C - O	C	C	C	C	C - O	EW	Verification; Environmental surface and groundwater monitoring. Outcome: Water related disease rates.	According to EMP	Company Contractor
	9.3	Crowding in project housing facilities	E W	-	E W	E W	E W	E W	Implement and monitor strict laundry	E W	E W	E W	E W	E W	E W	EW	Verification	Quarterly	Company Contractor

		Impact Areas & Timing							Mitigation Areas & Timing							Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R in g R	H o m a	K ik o ri	P 15 2	Mitigation strategies	H G C P	J u h a	R in g R	H o m a	K ik o ri	P 1 5 2				
		could create increases in skin diseases among workers that are then transmitted back to their home environment (lice infestations due to laundry and cleaning practices; scabies transmission due to close living quarters and personal contact. Home environments could create increases in skin diseases among workers that are then transmitted back to work camps (lice infestations due to laundry and cleaning practices; scabies transmission due to close living quarters and personal contact.	- O		- C	- C	- C	-O	and cleaning procedures in worker housing units. Verify camp living area configurations and occupants, prevent overcrowding and hot bunking.	- O	- C	- C	- C	- C	- O		Outcome: Skin disease rates in camp facilities.		tor
									Include skin evaluations, diagnosis and treatment on fitness to work and return to work examinations in full	E W - O	E W - C	E W - C	E W - C	E W - C	E W - O	EW	Verification	Q 6 months	Company Contractor

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G P	J u a	R i n g R	H o m a	K i k o r i	P 15 2	Mitigation strategies	H G P	J u a	R i n g R	H o m a	K i k o r i	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
									compliance with Project requirements.										
									Conduct Worker education. Provide support to local health services regarding prevention of sanitation/hygiene related diseases.	C - O	C	C	C	C	C - O	C	Verification	Annual	Company Contractor Partner PSI, CARE ADRA
	9.4	Influx of job seekers, service workers and clan members will increase use of unimproved sanitation, fecal oral related diseases. It is likely that landowners will rent living areas to Project workers and job seekers creating an increased demand for properly designed sanitation facilities and increases in fecal oral related diseases (example Kobalu area).	E W - O	-	-	E W - C	E W - C	E W - O	If workers are housed locally, provide assistance to achieve properly designed sanitation facilities that are culturally acceptable and meet the 1 to 25 ratio "compartment to users" according to predicted influx.	E W - O	-	E W - C	E W - C	E W - C	E W - O	EW	Verification Outcome: community usage of latrines.	Annual	Company Contractor Partner PNGIMR EU CARE ADRA, PSI
	9.4a		E W - O	-	-	E W - C	E W - C	E W - O	Educate workers – regarding the prevention of water, sanitation and waste	E W - O	C	E W - C	E W - C	E W - C	E W - O	EW	Process: Number of training sessions	Annual	Company Contractor

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g R	H o m a	K i k o r	P 15 2	Mitigation strategies	H G C P	J u h a	R i n g R	H o m a	K i k o r	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
									related diseases; provide pictorial handouts in local language for take home use.								conducted. Number of pictorial handouts provided for take home use.		
	9.4b		E W - O	-	-	E W - C	E W - C	E W - O	Provide support to develop and implements "Clean Hands" community and school based programs (CBHC).	E W - O	C	E W - C	E W - C	E W - C	E W - O	EW	Verification Process: Number of programs implemented.	Annual	Company Partner PSI, EU RWSSP, CARE ADRA
	9.5	Project waste could create fly breeding sites, increasing rates of eye infections and fly/sanitation related diarrheal diseases.	E W - O	-	E W - C	E W - C	E W - C	E W - O	Monitor Project waste management practices inside the fence and at the landfills.	E W - O	C	C	C	C	E W - O	EW	Verification: Environmental Monitoring program.	Per Env. Mon. Prog	Company Contractor
	9.6	Increased household waste related to influx could increase: Eye infections and other fly/sanitation related diseases: Rodent related diseases (typhus, gastrointestinal illnesses).	E W - O	-	E W - C	E W - C	E W - C	E W - O	Support marketplace community waste management programs.	E W - O	-	E W - C	E W - C	E W - C	E W - O	EW	Verification	Annual	Company PNG govt
	9.6a								Conduct worker education regarding household waste management. Provide	E W -	C	E W -	E W -	E W -	E W -	EW	Process: Number of training	Annual	Company Contractor

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g R	H o m a	K i m a	P 15 2	Mitigation strategies	H G C P	J u h a	R i n g R	H o m a	K i m a	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
									pictorial handouts for take home use.	O		C	C	C	O		programs conducted		
Food and Nutrition Related Issues	10.1	Food inflation associated with influx could further marginalize existing low income groups.	E W - O	-	E W - C	E W - C	E W - C	E W - O	Monitor food inflation.	E W - O	-	E W - C	E W - C	E W - C	E W - O	EW	Demographic Surveillance System (DSS).	Annual	Company Partner PNGIMR
	10.1a		E W - O	-	E W - C	E W - C	E W - C	E W - O	Conduct anthropometric monitoring (height, weight, age) and anemia screening within the PIA; evaluate results.	E W - O	-	E W - C	E W - C	E W - C	E W - O	EW	DSS	Annual	Company Partner PNGIMR
	10.2	(Positive Impact) Potential increased local income from the purchase of local fresh produce for Project catering services.	C- O	?	-	C	C	C- O	Establish formal equitable food purchasing contracts with approved suppliers for supply to Project facilities.	C - O	?	-	C	C	C - O	EW	DSS	Annual	Company Contract- or Partner PNGIMR
	10.3	Project facilities could create food related illness outbreaks that are transmitted to the PIA area communities.	C- O	C	C	C	C	C- O	Audit Project catering facility services, facilities and food waste disposal.	C - O	C	C	C	C	C - O	C	Verification Outcome: Food related illness outbreaks	Quarterly	Company Contract- or
	10.4	Project food waste could attract poisonous snakes and rodents.	C- O	C	C	C	C	C- O	Monitor on site Project food waste management. Establish and enforce strict policies and	C - O	C	C	C	C	C - O	C	Verification	Quarterly	Company Contract- or

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g R	H o m a	K i k o a	P 15 2	Mitigation strategies	H G C P	J u h a	R i n g R	H o m a	K i k o a	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
									practices for leftover site catering facility food products. Implement Project pest management plan.										
	10.4a								Conduct Worker education regarding food related disease prevention, Distribute pictorial handouts for take home use.	C - O	C	C	C	C	C - O	C	Process: Number of training programs completed.	Annual	Company Contractor
Accidents and Injuries (Community Safety)	11.1	Increased Project related roadway traffic and associated accidents (pigs and people) from Project transportation assets.	E W - O	C	E W - C	E W - C	E W - C	E W - O	Conduct safety training verification for all drivers; including photo ID system or fingerprinting system for all training completed.	E W - O	C	E W - C	E W - C	E W - C	E W - O	EW	Verification Outcome: Project related road traffic accidents in the community.	Q 6 months	Company Contractor
	11.1a		E W - O	C	E W - C	E W - C	E W - C	E W - O	Pictorial road safety signage, signals and barricades including Pidgin, Huli and English language descriptions along Project roadways & surrounding Project facilities.	E W - O	C	E W - C	E W - C	E W - C	E W - O	EW	Verification Outcome: Project related road traffic accidents in the community.	Quarterly	Contractor
	11.2	Increase in roadway accidents and injuries related to influx and Social Ability to Operate.	E W - O	C	E W - C	E W - C	E W - C	E W - O	Provide support for and implement community and school based road safety programs.	E W - O	C	E W - C	E W - C	E W - C	E W - O	EW	Verification Outcome: Project related road traffic accidents in the	Annual	Company

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g R	H o m a	K i k o r	P 15 2	Mitigation strategies	H G C P	J u h a	R i n g R	H o m a	K i k o r	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
																	community. (refer Traffic MP)		
Social Determinants of Health (violence, cultural clashes, etc)	12.1	Mixing of cultural groups in Project work camps; could create cross cultural violence.	E W - O	C	E W - C	E W - C	E W - C	E W - O	Manage cross cultural issues at work camps for TCNs, Huli and other PNG ethnic groups. Provide Transportation programs for local workers from work site to and from home. Implement zero tolerance for violence, weapons, verbal abuse. Conduct Worker education.	E W - O	C	E W - C	E W - C	E W - C	E W - O	EW	Verification	Q 6 months	Company Contractor
	12.2	Opening of roadways creating internal in-migration; Influx of different cultural groups; will disrupt social cohesion.	C- O	C	C	C	C	C- O	Establish system to monitor violence at the community level. (Security) Implement Social impact management programs. Conduct Worker education.	C - O	C	C	C	C	C - O	EW	Verification Process: Number of training programs conducted.	Q 6 months	Company Partner PNGIMR
	12.3	Increased income by some community members disrupting social cohesion, increasing drug	C- O	C	C	C	C	C- O	Collaborate with church groups to create dry zones. Conduct Worker education. Implement Social impact management	C - O	C	C	C	C	C - O	EW	Verification Process: Number of training programs conducted.	Q 6 months	Company Contractor Partner PNGIMR

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R in g R	H o m a	K ik o a	P 15 2	Mitigation strategies	H G C P	J u h a	R in g R	H o m a	K ik o a	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
		and alcohol use and increasing violence.							programs.										
	12.4	Changes in income and expenditures creating conflict inside the Project camps.	C-O	C	C	C	C	C-O	Implement Work camp alcohol and drug restrictions (dry camps) and gambling prohibitions. Conduct Worker education regarding camp behavior.	C-O	C	C	C	C	C-O	EW	Verification Process: Number of training programs conducted.	Annual	Company Contractor
	12.5	Opening of new roadways will increase the access to, availability and use of buai (betel nut use), tobacco, alcohol, drugs, etc. resulting in adverse health effects.	C-O	-	C-O	C-O	C-O	C-O	Conduct Worker education; provide pictorial handouts for take home use. Provide educational materials to community Health Services personnel and local schools.	C-O	-	C-O	C-O	C-O	C-O	C	Process: Number of training programs conducted.	Annual	Company Contractor Partner TBD
Hazardous Materials Exposure; poison control issues	13.1	Potential Project facility releases to air, groundwater and surface water.	C-O	C	C	C	C	C-O	Implement environmental monitoring programs (air emissions, water, etc).	C-O	C	C	C	C	C-O	EW	(See EMP)		Company Contractor
									Manage noise exposure to community per design specs.	C-O	C	C	C	C	C-O	EW	(See EMP) Outcome		Company Contractor
									Implement spill response plan to include response to Project related spills	C-O	C	C	C	C	C-O	EW	(See EMP) Verification Outcome		Company Contractor

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g R	H o m a	K i k o a	P 15 2	Mitigation strategies	H G C P	J u h a	R i n g R	H o m a	K i k o a	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
									that may occur in the community and conduct drills.										
	13.2	Hazardous materials containers could be used for rainwater catchment in local communities.	E W - O	C	E W - C	E W - C	E W - C	E W - O	Monitor chemical control and container/waste management programs. Implement daily patrols to confirm good housekeeping of containers dispose of according to Project specifications.	E W - O	C	E W - C	E W - C	E W - C	E W - O	EW	See EMP Verification		Company Contractor
	13.3	Community exposure to hazardous materials from roadway accidents along the transportation route.	C- O	C	C	C	C	C- O	Ensure that hazardous materials response plan includes response to offsite Project related spills in the community.	C - O	C	C	C	C	C - O	EW	See EMP Verification		Company Contractor
	13.4	Community exposure to insecticides used for malaria control activities inside the fenceline via air, soil and water routes.	C- O	C	C	C	C	C- O	Monitor insecticide release.	C - O	C	C	C	C	C - O	EW	Verification Outcome: levels of insecticides used inside the fence in adjacent communities.	Ongoing	Company Contractor
	13.5	Sewage Treatment Plant or structure overflow.	C- O	C	C	C	C	C- O	Gray water and black water management and monitoring.	C - O	C	C	C	C	C - O	EW	See EMP	Ongoing	Company Contractor
	13.6	Snake habitat disturbance during	E W	C	E W	E W	E W	E W	Communicate increase in snake	E W	C	E W	E W	E W	E W	EW	Verification	At start of habitat	Company Contractor

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R i n g R	H o m a	K i k o r i	P 15 2	Mitigation strategies	H G C P	J u h a	R i n g R	H o m a	K i k o r i	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
		site clearing activities could increase snake migration into local communities.	-C		-C	-C	-C	-C	migration during site clearing.	-C		-C	-C	-C	-C			disturbance	or
	13.6a								Facilitate access to anti-venoms at local/company health centers.	E W - O	C	E W - C	E W - C	E W - C	E W - O	EW	Verification	Annual	Company Contractor
Respiratory, Housing (increased transmission of respiratory diseases)	14.1	PNG nationals who reside in work camps and travel home during off times could potentially transmit respiratory infections from the Project to their home community. Specific worker housing design and capacity versus planned inhabitants.	E W - C	C	E W - C	E W - C	E W - C	E W - C	Implement TB prevention and control program with medical confirmation of TB status before assignment.	E W - O	C	E W - C	E W - C	E W - C	E W - O	EW	Verification	Quarterly	Company Contractor
	14.1a								Follow up with family members of workers diagnosed with TB at work camp.	C - O	C	C	C	C	C - O	EW	Verification Outcome: Percent follow up of workers diagnosed with TB.	Quarterly	Company Partner PNGIMR
	14.1b								Adhere to appropriate worker housing design and capacity.	C - O	C	C	C	C	C - O	EW	Verification	Annual	Company Contractor
	14.2	Community influx creating	C-	-	C	C	C	C-	Support national TB control program;	C -	C	C	C	C	C -	EW	Verification	Annual	Company Provincial

Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R in g R	H o m a	K ik o ri	P 15 2	Mitigation strategies	H G C P	J u h a	R in g R	H o m a	K ik o ri	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitoring frequency	Responsibility - Partner
		overcrowding further compounding high local TB rates and inadequate local health service capacity.	O					O	partnership in providing services in the Project area.	O					O				govt Partner PNGIMR ADB
Non Communicable Diseases	15.1	Changes in NCD rates in national workforce employees due to changes in nutrition habits and food availability through the Project.	E W - O	C	E W - C	E W - C	E W - C	E W - O	BP, blood glucose and anthropometric monitoring of Project workforce. Worker/community education. Rotation of local health care personnel through project health services for information transfer and capacity building.	E W - O	C	E W - C	E W - C	E W - C	E W - O	EW	Verification Outcome: NCD rates in national workforce.	Annual	Company Contractor Partner Provincial govt
Veterinary Medicine/Zoonotic Diseases	17.1	Movement of people and animals (particularly pigs) can transfer animal related diseases from one geographic area to another. Pigs carry zoonotic diseases in PNG that can be transmitted to humans.	C - O	-	C	C	C	C - O	Evaluate medical status of pigs providing to individuals as compensation.	C - O	-	C	C	C	C - O	C	Verification	Annual	Company Partner TBD
Resettlement Populations (Hides, Komo etc)	18.1	Multiple potential health impacts related to involuntary resettlement, such	E W - O		E W - O				To be monitored and addressed in the Social Resettlement Action Plan.							Now	Verification through DSS.		Company

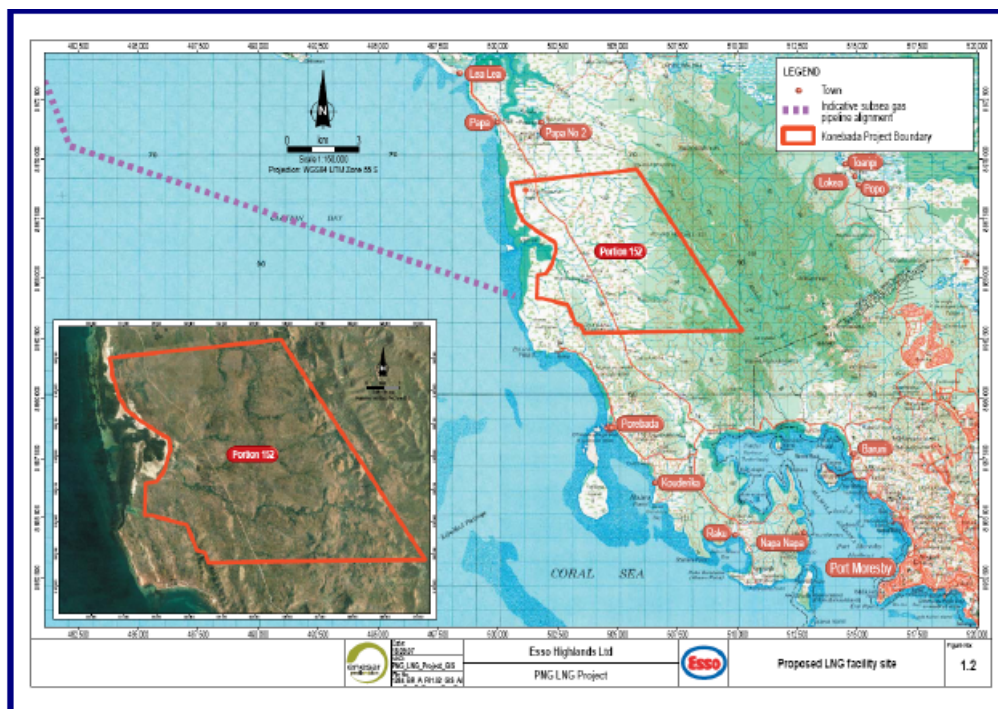
Impact Areas & Timing										Mitigation Areas & Timing									
Health Impact Assessment Environmental Health Area	Ref No.	Anticipated Impacts	H G C P	J u h a	R in g R	H o m a	K ik o a	P 15 2	Mitigation strategies	H G C P	J u h a	R in g R	H o m a	K ik o a	P 1 5 2	Optimal Time for Mitigation Strategy	Monitoring	Monitor- ing frequency	Respon- sibility - Partner
		as access to health care, nutrition status, movement from an area of low malaria transmission to an area of high transmission, increases in violence.																	

ATTACHMENT 3: PNG DEMOGRAPHIC SURVEILLANCE SYSTEM (DSS)

1.0 INTRODUCTION

The Project is a large industrial project located at multiple sites in Papua New Guinea. Post construction phase, the downstream Project will be primarily centered in LNG area, located in the Central Province. The site is approximately 20 north-east of Port Moresby (National Capital Province) in Caution Bay between the villages of Boera and Papa. The area is approximately 4000 ha. The general location near the LNG site includes several lots that are state owned and foreshadowed to become part of what is known as the Konebada Petroleum Park (KPP). There are significant expansion and development plans for KPP including development of large methanol/dimethylether (DME), urea/fertilizer plants that would employ over 4000 workers during operations. The construction phase workforce would potentially be significantly larger. The InterOil refinery (commissioned in 2004) already operates in KPP. The LNG area site is 'greenfield'; however, the surrounding area is clearly a brownfield peri-urban location that has undoubtedly experienced some level of growth and subsequent population in-migration.

As shown on the map below, there are other relevant population centers, i.e., Porebada, Lea Lea, that are within 5-10 km of LNG area. According to the 2000 census, there was a population of 8,000 individuals in the four villages closest to LNG area. Porebada is the largest village with an estimated 2000 population of 4500.



The permanent portion of the upstream Project will be the Hides Gas Conditioning Plant (HGCP) located in the Southern Highlands Province (SHP). There will be significant construction activity associated with the HGCP and accompanying infrastructure. However, during operations, the HGCP will be significantly smaller in terms of permanent operating staff versus the downstream LNG site. Hence, the strategies necessary to assess long-term impacts at the downstream location are potentially different than for the upstream site.

In order to adequately establish baseline conditions and monitor potential impacts, both positive and negative, the Project has already undertaken a variety of population and individual household level surveys covering such diverse areas as social, environmental,

financial, livelihood, and health. These survey efforts began during the preparation of pre-construction environmental, social and health impact assessments. Survey and data management efforts are performed by a variety of external contractors and managed by the Company. Due to the size and complexity of the anticipated monitoring and evaluation (M&E) efforts, the Project is evaluating a range of scientifically effective, long-term and cost-efficient options. Technically, one of the most efficient solutions to measurement and verification needs is establishment of a formal demographic surveillance system (DSS). The large, “permanent” (estimated operation 25 years) downstream LNG facility and associated environs are well suited for a DSS site.

A DSS is a longitudinal population based surveillance system that may collect a variety of population and household level data covering all aspects of a target population(s). The DSS can efficiently and systematically collect data that would otherwise be obtained by numerous individual household survey efforts that are often triggered by ad hoc needs of environmental, social and health monitoring programs.

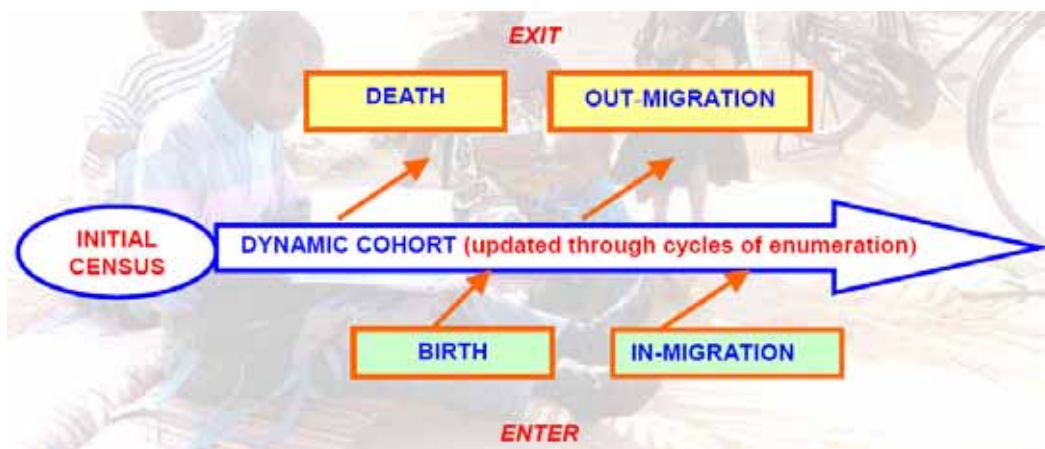
Demographic Surveillance Systems (DSS)

- A means to integrate census and surveys, longitudinally

A DSS must include two basic operations:

- 1) a baseline census that defines the study population and records (at minimum) the age and sex of population members; and
- 2) mechanisms for monitoring births, deaths, and migrations on an ongoing basis.

Most systems also include mechanisms to identify members’ household/familial relationships and marital status, cause of death, and covariates of (i.e., factors affecting) demographic rates (such as individuals’ educational, economic, and health status). In addition, key physical characteristics of households are also surveyed, e.g., number of rooms, household construction characteristics, water supply, sanitation, etc. In general, overall risks/impacts to individual households and populations cannot be monitored unless all components of demographic dynamics are observed.

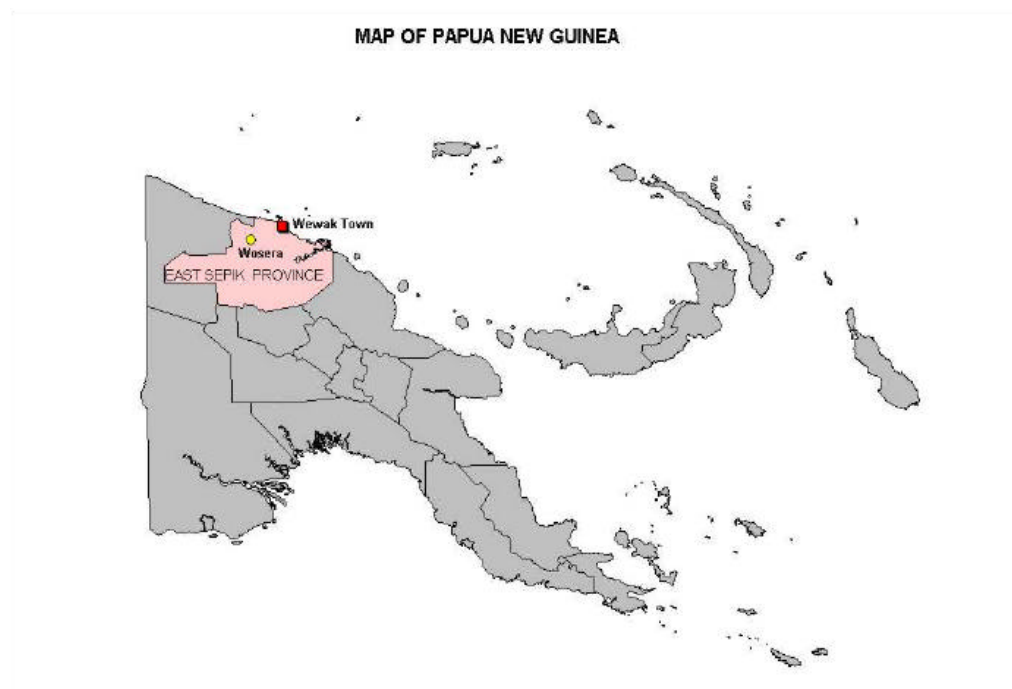


The most advanced surveillance systems serve as platforms for a range of objective evaluations. Investigations linked to a DSS may focus on diverse subjects (e.g., behavioral,

social, economic, or health issues) and may be quantitative, qualitative, or both. The diversity of possible assessments is quite large and may include such efforts as malaria prevalence surveys, pilot projects promoting healthy behaviors or changes in educational attainment by household members. Virtually all of the most critical social and health measurement surveys can be performed by a DSS platform. In addition, certain environmental surveys can also be performed within the DSS framework.

-
- Typical DSS can produce over 100 demographic, health and poverty indicators for understanding trends and determinants for:
 - population characteristics
 - household characteristics, assets and wealth indexing
 - health status / disease burdens
 - access, use and impact of health services
 - health seeking behaviours for severe and fatal conditions
 - environmental and spatial contexts, risks, exposures
 - household food security
 - impact of poverty reduction strategies
 - impact of health interventions
 - timely evidence for planning and setting priorities

In a developing country setting, DSS has become one of the most successful platforms for obtaining objective high quality and transparent population and household level information. Since 1990, there has been an existing DSS site, Wosera, in PNG with a long and distinguished scientific record of achievement.



DSS in Papua New Guinea is organized and managed by the PNG Institute of Medical Research (PNGIMR), an agency of the PNG National Department of Health (NDOH). PNG DSS efforts are part of the larger international effort known as the INDEPTH Network.

The Wosera site is part of the Wosera –Gawi district in the East Sepik Province of Papua New Guinea. It lies approximately 75 km WSW of the provincial capital Wewak and 15-20

km south of the local administration centre in Maprik. The Wosera DSS catchment area contains a total of 30 villages each consisting of several distinct hamlets. Catchment population is 10-12,000.



Wosera DSS data collection and processing consists of:

- Yearly complete population censuses
Planned by demography supervisor at IMR Maprik and carried by IMR staff in order to cross-check regular reporting of village based demography reporters. The annual census also records newly built houses, GPS their locations and assigns new house numbers if necessary.
- Fortnightly updates
40 village based demography reporters controlled by 4 specially trained reporter supervisors record any demographic events such as in- & out-migration, births, deaths and pregnancies. The data collected are sent to the demography supervisor at IMR Maprik fortnightly.
- Verbal autopsies
Verbal autopsies are conducted following every death reported by medically trained IMR staff
- Morbidity surveillance:
A morbidity surveillance system is maintained at both health centers within the DSA. All patients seen by the health centre staff and their diagnosis are recorded. From patients with symptoms of presumptive malaria, the patient is physically examined by the IMR surveillance nurse, blood slides are collected and hemoglobin levels measured.

Other data are collected as required by individual studies.

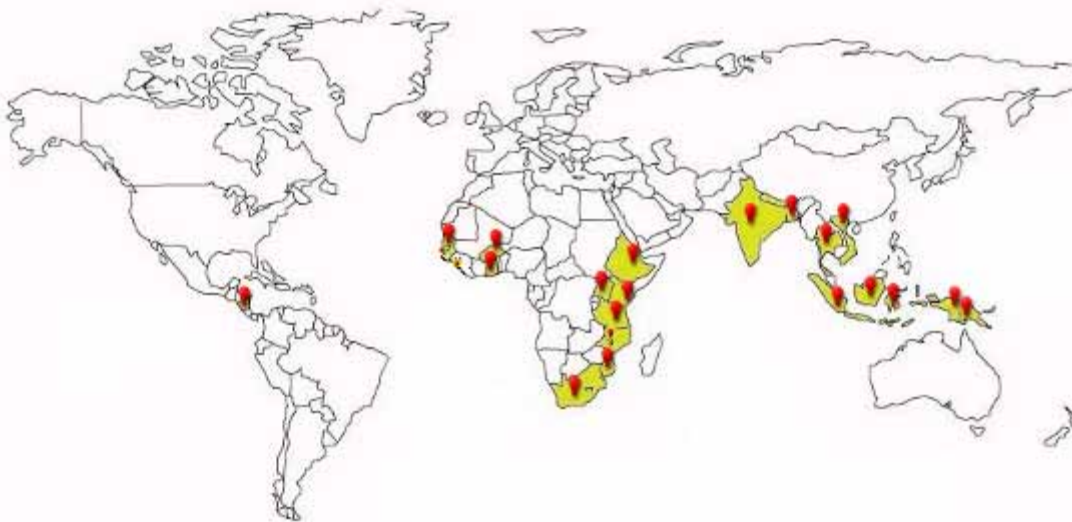
The Wosera DSS does not operate in a vacuum and is part of a larger system of DSS sites around the world known as the INDEPTH Network. The INDEPTH Network (<http://www.indepth-network.org/>) is the umbrella organization that co-ordinates the worldwide developing country demographic surveillance effort. INDEPTH is a not-for-profit organization that currently consists of 37 health and

demographic surveillance system (HDSS) sites in 19 countries in Africa, Asia, Central America and Oceania that collectively monitors over 2 million people at a household-level. Several countries have multiple DSS projects.

The INDEPTH Network acts as a coordinating and capacity building organization in order to:

- Maximize connectivity among member sites to enable timely and reliable transfer of data, best practice sharing, expertise sharing and overall collaboration.
- Standardize best-practice methodologies to ensure the consistency and quality of network data.
- Enhance the skill sets of INDEPTH and network member staff through on-site training courses, fellowships and collaboration with INDEPTH partners.
- Provide assistance to sites in interpreting and packaging data to maximize policy and programmatic influence.

In-Depth Network global Location Map



In order to maximize scientific credibility and achieve rapid start-up and operational efficiency, the proposed PNG LNG DSS would be established under the direct management and control of PNG IMR. By incorporating an LNG DSS within the existing PNGIMR structure there are significant operational and start-up efficiencies that would be gained.

2.0 PNG LNG DSS

The purpose of the PNG LNG DSS would be to provide a stable high quality sound science, platform that would perform M&E, research, and long-term national capacity building:

2.1 Service

- To contribute to the development of PNG social services and health planning providing unique, essential, household level information for a critical peri-urban area (LNG area and environs) that is also “home” to the Project;
- Monitoring and Evaluation:
- To provide a platform for high quality, transparently collected household and population survey data for assessment of impacts, both positive and negative, in the Project area of influence; and

- To develop a parallel control site near Madang using existing, longstanding DSS capabilities.

2.2 Research and National Capacity Building

- To provide a long-term platform for national training in applied field research related to practical health, socio-economic and demographic survey methods in the context of a large industrial project in a developing country peri-urban setting.

2.3 PNG LNG DSS Key Objectives

2.3.1 Objective 1: Service

- To document key demographic variables, e.g., in-migrations, out-migrations, socio-economic status, etc., in a coastal population located next to a world class industrial facility; LNG area is in a designed industrial area (Konebada Petroleum Park) that is likely to experience significant growth and development;
- To develop a suitable control site so that potential PNG LNG impacts, positive and negative, can be adequately analyzed and compared;
- To provide and promote the use of DSS information in the PNG NDOH thus enabling appropriate and objective assessment for health and social sector planning related to industrial development projects; and
- To ensure and develop an objective and transparent scientific database related to the presence of a large industrial project in a peri-urban setting. If the Konebada Petroleum Park (KPP) develops as proposed, i.e., the methanol/DME facilities, there will be significant influx and industrial development in areas adjacent to but outside of the LNG facility.

2.3.2 Objective 2: Monitoring and Evaluation

- To provide a platform for longitudinal, trans-disciplinary investigation of potential impacts, positive and negative, on household and population level determinants of poverty, socioeconomic inequalities, services access/utilization, poverty/livelihood alleviation interventions, and health. It will be extremely important to carefully and objectively document key social, economic and health changes that are associated with the Project versus the general expansion and development of KPP.

2.3.3 Objective 3: Research and National Capacity Building

- To offer facilities for practical field training in applied health research, demography, socio-economic and population development issues.

2.4 Beneficiaries of the PNG LNG DSS

2.4.1 Government

Especially National Department of Health (NDOH), Ministry of Education, National Statistics Office.

2.4.2 International Financial Institutions (IFIs) and other key multilateral organizations

Transparent measurement and verification that project environment, social and health commitments have been kept. Multi-laterals such as Asian Development Bank (ADB) and key development agencies (e.g., AusAID) can use DSS as a platform for further development support.

2.4.3 Academia and Research Institutions

PNG national institutions and faculties of medicine, public health, demography, epidemiology and social sciences but also including international research institutions.

2.4.4 NGOs

Especially those dedicated to health, nutrition, family planning, welfare and poverty alleviation.

2.4.5 International Foundations

Leading international foundations, e.g., Gates, Hewlett, Rockefeller, are attracted to DSS, especially when initial core start-up funding is in place.

2.4.6 Private Sector

Especially companies who wish to develop natural resources in PNG.

2.5 **Funding Sources**

The initial driving force for the PNG LNG DSS site would be the Company. The role of EHL would be to become a founding development partner for the LNG DSS. The term “development partner” refers to those organization, i.e., major scientific institutions (e.g., Swiss Tropical Institute, London School Hygiene & Tropical Medicine) and foundations (e.g., Gates, Hewlett, Rockefeller and Mellon Foundations, Wellcome Trust, etc.) that provide initial start-up core funding for a DSS.

DSS generates longitudinal data by nature and is an ideal platform for an extractive industry project that is interested in long-term verification and measurement (monitoring and evaluation). Therefore, it is proposed that EHL consider becoming a core developmental partner in establishing a DSS focused initially on LNG area. A suitable control site will also be needed in order to analyze potential impacts.

EHL would be a critical initial development partner; however, to become fully stable, it is essential that the PNG LNG DSS diversify its funding sources. To do this, the site will need to attract funding outside of EHL. At present, the PNGIMR has a diversified set of funding partners. It is anticipated that this situation will continue and further develop as the PNG LNG site provides a unique opportunity to evaluate the impacts, positive and negative, of industrial development (particularly oil/gas) in a peri-urban developing country setting. The LNG facility is located in the KPP, a location only 20km distant from the national capital, Port Moresby. Hence, the government of PNG has a long-term vested interest in understanding the direct and indirect effects of major industrial development immediately adjacent to the national capital district.

From a research perspective, the PNG LNG DSS would be unique and should attract substantial international interest from those bilateral/multilateral and academic institutions that are interested in development economics, social assessment and health. In addition, the PNG LNG DSS site could diversify its funding sources by showcasing the unique data analysis opportunities that would be present. This could place the PNG LNG DSS in a position to have a huge positive impact on national training in the social and health sciences. The Project has significant national content goals and the DSS would provide a long-term platform for enhanced and specialized national training in areas that are currently either limited or unavailable in PNG.

2.6 **INDEPTH Network Membership**

The INDEPTH Network was established to assist the community of DSS sites to promote and disseminate their work more widely, and to join together to tackle questions that need multiple field sites to address efficiently. Membership in INDEPTH is also a strategy to sustain the value of DSS to local, national and international communities. The PNGIMR is a

current member of the INDEPTH Network; therefore, all of the start-up activities and ongoing rounds of survey work would be performed within the established INDEPTH Network protocols and procedures.

2.7 Community Liaison

DSS by its nature has a start date but no end date. It goes on as long as it is needed and there are funds available. This means the dynamics of the population under surveillance are going to be followed closely until an individual exits from the population under surveillance through death or migration. The periodic follow ups of persons enumerated in a DSS throughout their life time may pose challenges to DSS sites with regard to respondent (survey) fatigue. Fortunately, “survey fatigue” has not occurred or been documented in any of the 37 DSS sites in the INDEPTH Network, despite the fact that some of these sites have been operating for many years. For example Niakhar DSS in Senegal, Matlab DSS in Bangladesh and Navrongo DSS in Ghana have been going on for, 44, 40 and 15 years respectively, but there has not been any indication that the communities are tired of their activities. The sites continue to enjoy excellent cooperation from their respective communities and host governments. However, it is prudent to strengthen this relationship to ensure that respondent fatigue does not set in. Some of the strategies being adopted include:

- Periodic interaction with the people through community meetings which help to facilitate the understanding of longitudinal surveys by the communities. During such meetings some findings are disseminated to the people;
- Any add-on module goes with community sensitization on the module even if the activity has been going on at each round or annually. This serves as a reminder strategy and helps improve the understanding of work by the community;
- In addition to holding of community meetings, interacting with key community stakeholders and institutions such as churches, councils, chiefs, provincial health authorities or opinion leaders is a useful tool in sustaining their interest. Periodically key community leaders are invited to the DSS office centre to interact with other staff and also be introduced to some of the activities that are going on in the DSS;
- The district political institution is not left out. The meetings of local authorities provide a useful opportunity for the dissemination of findings and explanations of DSS activities;
- Where it is possible to reach the people on AM or FM radio stations, frequent dissemination of core activities after each round or periodically has been used successfully to inform the communities which keeps on increasing their knowledge and understanding of DSS activities;
- Production and distribution of simple reading materials and feedback newsletters about sites and their activities and circulating it in the host communities. These types of efforts improve the community perception of longitudinal surveys;
- Field workers have been living in their Field Worker Area. They are seen as members of the community. Periodically they are swapped across areas so that their experiences and challenges benefit other areas. Also it helps the management team to easily identify field workers who are not performing well with the community and quickly address the issue; and
- DSS field staffs are typically drawn from the local communities that are followed by DSS. This enhances credibility and trust in addition to building capacity and providing employment.

2.8 DSS Products

DSS sites generate a wealth of longitudinal data and information at the household level. However, there are a number of issues related to ownership of the data that must be considered:

- Is the source data in question resulting from core DSS activities or a result of research projects conducted within the DSS?; and
- Who has paid for the information and what is their position on the public goods value of the information produced?

Potential consumers of DSS information include the local health system as well as national and international health sector partners; those concerned with monitoring poverty reduction and progress towards Millennium Development Goals; other sectors and disciplines such as education, agriculture, and civil registration.

Currently, data collected by PNGIMR falls under the confidentiality and access rules that govern the PNG NDOH. In addition, the INDEPTH Network has specific rules governing access to and release of information. Unrestricted “data mining” is not permitted nor can external organizations, e.g., NGOs, gain access to commissioned surveys or raw data files. From an EHL perspective the access to Project-specific surveys must be carefully explored and delineated. In addition, the timing, format and release of commissioned surveys must be established between EHL and PNGIMR management.

2.9 Financial Management

A sound financial management system is one of the effective ways to sustain a DSS. Due to their locations in different countries in the developing world and the fact that the sites are run by different institutions, there are understandable differences in the financial systems maintained by the sites. INDEPTH has previously organized workshops for DSS site financial managers to share their experiences in running the DSS. There are a series of financial templates that have been prepared by the INDEPTH Network for calculating start-up and running costs for a typical DSS. A full financial pro forma must be performed as part of the feasibility analysis for a PNG LNG DSS. However, the financial analysis is partially dependent upon:

- Number and frequency of DSS surveys;
- Catchment area size and development of a suitable control location; and
- Economy of scale benefits obtained by using the established PNGIMR platform/experience/management.

2.10 Census & Core Parameters

An initial critical activity for assign costs and feasibility is assessing the existing census and core parameters database. Basic household registration includes these essential core variables:

- Name;
- Date of Birth;
- Sex;
- Relationship to head of household;
- Main residence (questions dictated by residency and membership rules adopted by the site); and
- Location of household (assigning IDs).

PNGIMR has experience with the computerized Household Registration System (HRS) as developed for the INDEPTH Network. The HRS is a core system that is essential for the functioning and performance of the DSS.

2.11 Household Registration System

The Household Registration System is a critical product in the population field: a DSS computer program template. This software system can generate any number of site-specific DSS programs, according to user specifications, and can be customized to the needs of almost any demographic/health surveillance operation.

The heart of the HRS is a 'core system' that serves as the foundation for every DSS program generated by the HRS. The core is based on the principle that certain characteristics of households, household members, relationships, and demographic events are common to most studies of human populations.

The HRS uses the household as the basic unit of analysis because this is known to be a productive approach to demographic and health research. The core system is a foundation on which many different structures can be built. Programs generated by the HRS can be tailored in any number of ways to suit different study requirements. For example, the HRS can be adapted to studies of social structures other than (or in addition to) households, such as extended families and kinship networks; and it can be adapted to accommodate additional information, such as data on specific events or household/individual characteristics. Users can extend the basic program by adding to it small units, or modules, of computer code that correspond to specified functions. Code modules can be constructed by computer specialists at remote locales, and then transferred electronically to field sites.

The HRS generates DSS programs that perform three basic functions:

- Maintain a consistent record of baseline and longitudinal data on households and household members in a geographically defined population;
- Generate all printed documentation for field and computer operations—instruction manuals, data-collection books (called field registers or household/compound registration books), interviewing guidelines, error reports, and other materials; and
- Produce a standard package of statistics—including demographic rates (fertility, mortality, migration) for the overall population, for subsets of the population, and for different time intervals; population distributions by sex, age, and geographic area; and life tables.

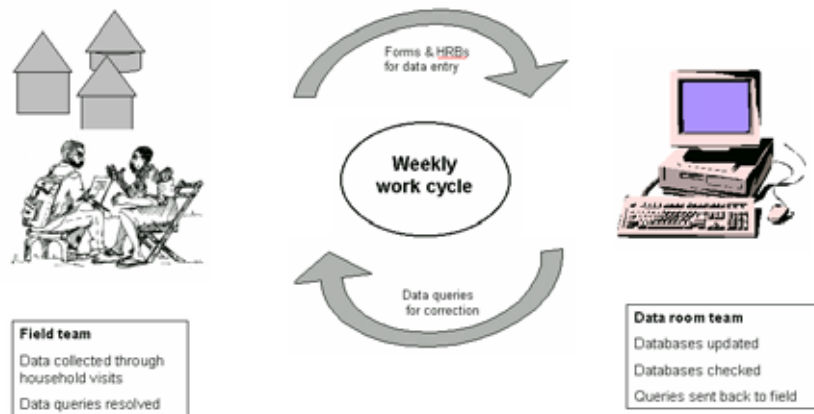
The interactive, visual, menu-driven format of the HRS allows users to define study parameters, enter and edit data, and generate reports with the click of a mouse. The HRS largely dictates how data collection/entry/management/analysis are undertaken in an HRS-based DSS. The system specifies procedures to be followed in the field and on the computer; it coordinates field and computer operations; and it synchronizes these operations within a fixed work cycle.

2.12 Registration updated every round

After the startup (census) core baseline round where all households and members of the DSS are registered, all subsequent rounds are concerned with updating events in this population. In the HRS system, the Household Registration or Record Book (HRB) is the key document. Depending on what events are occurring during the update period, additional forms are used to capture the details on these core events. Some events need to be captured on a continuous basis such as pregnancies, births and deaths and these core events need to be recorded during every update round of the DSS. Other events such as education status may only change once per year and only need to have registration updated

annually or less frequently. A major consideration is determining the level of 'updating' that is required for the PNG LNG DSS.

Integrated field and data systems



2.13 Quality Assurance/Quality Control (QA/QC)

Certain measures are employed to ensure that field workers meet satisfactory levels of performance. In any survey work, if supervision of data collection is not adequate, it leaves enough room for one to be skeptical about the reliability and validity of the data. The role of the supervisor is to provide support to field workers in their day-to-day activities so that they can improve on their existing practice and maintain high standards of data collection and also serve as a channel through which fieldworker concerns can be fed through to the field office. Their main purpose is to ensure that high standards for data collection are maintained all the time. To ensure maximum reliability and validity of data, an intensive but simple supervision procedure should be adopted. This supervisory procedure includes the following measures: scheduled visits or supervised interviews by appointment to observe field workers performing their assigned job, random unscheduled visit which should not be communicated to the fieldworker to pick up any unacceptable practices that may have cropped up in the course of fieldwork and check visits to perform a specific task such as verifying whether a reported visit was made or discuss concerns of people registered into the DSS. These procedures are well established within PNGIMR and would be applied to the LNG DSS.

Ensuring data accuracy and consistency is a top priority of the HRS. Rigorous field and computer protocols are built into the system. The standard cycle is 90 days. However, the HRS can be adjusted to accommodate a work cycle of any specified duration to maintain a "clean" database.

Interviewing procedures are standardized and detailed; field registers are designed to minimize data errors and field supervisors routinely visit a sample of households to check the quality of data-collection work. Data entered into the computer must pass through a gauntlet of error trapping procedures, which check the logic of events, dates, relationships, and so forth. Data failing any of these tests cannot be inserted into the database; this is one of the most powerful features of the program. If a data inconsistency is detected—for instance, if a birth is reported in a household where no mother is registered—a message identifying the problem appears on the computer screen. The information is re-entered to rule out a data-entry error; if the problem persists, the system generates an error report, which is used to determine the steps that must be taken to correct the error.

The HRS significantly reduces the cost and complexity of longitudinal population-based surveillance. The program can run on moderately priced microcomputers housed in a field station and can be operated by computer non specialists with remote technical assistance; therefore, it eliminates the need for expensive computer hardware, off-site computer facilities, and specialists to run DSS programs.

Field and computer operations are proximate to each other in an HRS-based DSS; therefore, these operations can be coordinated easily, data can be transferred from the field to the computer quickly, and data can be checked and corrected efficiently. This eliminates logistical complexities, inefficiencies, and data-management costs of systems in which field and computer operations are far apart. But the biggest cost savings of the HRS is up front: the program is free—in other words, it eliminates the extremely costly effort of a custom-built DSS program.

Experience at other large and complex developing country industrial sites indicates that (i) data QA/QC for field surveys and (ii) internal processing and management systems are significant technical issues that can seriously and adversely impact survey efforts. The HRS should significantly improve both the quality and cost profile for this effort for the LNG site.

New technologies improving DSS cost-efficiency



2.14 Surveys

There are a large variety of survey instruments that have been developed within the INDEPTH Network. Therefore, it is unlikely that costly new survey instrument development will be necessary. The existing INDEPTH library of surveys should cover the needs of the LNG site for the foreseeable future. Standard surveys covering financial, socio-economic, social cohesion and well-being are readily available. In addition, there is a substantial list of health questionnaires that are available. Brief examples of some of the existing surveys are:

- Household Food Security

Food security is defined as the availability of and accessibility to sufficient food at all times for all people. Sufficient food refers to both quantity and quality needed for good health. Food security is one of the major concerns of developing countries despite the efforts to improve food situation in the world. Food security can be viewed at different spatial levels: global, national, household, and individual. Increasing attention is made at household and individual level because achieving food security at both global and national levels does not necessarily mean food availability and accessibility at household level.

Household food security can be measured using several indicators. The basic indicator is Adult Equivalent (AE) kilocalories per day. In addition,

several other possible indicators can be used and are readily available within the INDEPTH system. The best practice is to collect these indicators once in every DSS round; this allows longitudinal food security monitoring.

- Sexual Behavior

There is an increasing concern about the health, social and economic problems associated with reproductive tract infections. The spread of STIs in the community and risky sexual behavior among sexually active adult population has been identified as a significant potential concern in the health impact assessment, particularly during major construction activities. An initial round of STI/sexual behavior data was captured at Moro and Kikori in 2006 surveys; however, there are no data for the LNG area. This is a critical gap that can be filled by the DSS in a confidential and scientific manner.

- HIV Sero-Status

HIV sero-status surveys are very sensitive and need to be properly planned for confidentiality purposes and the use of Good Laboratory Practice (GLP). There is a need to consider whether the testing is for screening purposes or for HIV prevalence, incidence and risk factors of HIV transmission and acquisition. In addition, any testing must be compliant with the HAMP Act.

- Maternal Mortality

Poverty, disease and access to appropriate and cost-effective services constitute the main constraints to reducing maternal mortality. Measuring maternal mortality accurately is a sensitive indicator of changes in household level health and is highly responsive to changes in income poverty and access to health care. Data on maternal mortality can be collected as a specific module during a given round of data collection

- Tobacco and Betel Nut Chewing

Although smoking and betel nut chewing have been identified as major causes of illness and death, the trends of tobacco use and betel nut chewing in PNG are not well measured. The DSS serves as useful platform for measuring incidence and trend of smoking and betel nut chewing among population. The introduction of one or two questions into an existing data collection tool in a particular round on an annual or biannual basis is easily done.

- Alcohol and Drugs

Alcohol and drug abuse is on the increase in the developing world. Alcohol and drug abuse has also been associated with increased psycho-social and mental health problems in these countries. The introduction of one or two questions into an existing data collection tool in a particular round on an annual, biannual basis can yield valuable trend data.

- Domestic Violence

Domestic violence has been identified as a key issue that affects women. It is exacerbated in developing countries because of poverty, the complexities of social institutions and structures and the subordinated roles performed by women. The reported level of domestic violence is low because it is socially acceptable for spouses to abuse their partners.

- Household Malaria Surveys

PNG IMR has extensive experience performing malaria prevalence surveys and is well recognized internationally for work on malaria, including recent vaccine development clinical trials.

2.15 Summary Key Issues

In order to further implement the technical and financial feasibility of establishing a PNG LNG DSS within the existing PNGIMR framework, several key issues must be further explored:

- Overall management structure and accountability;
- Financial pro forma for start-up and anticipated yearly operations;
- Definition of the Project areas of influence and selection of a suitable control site;
- Establishment of formal population catchment area so that adequate coverage is obtained;
- Definition of anticipated survey needs and products;
- Deliverable schedules;
- Definition of survey frequencies;
- Confidentiality and data access;
- National content and training development; and
- Potential international partners and additional funding sources.