



Proposed Angola LNG Project
Environmental, Socioeconomic,
and Health Impact Assessment
(ESHIA)

SCOPING PHASE

SUPPORTING DOCUMENT

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Scoping Phase Supporting Document for the Angola LNG Project

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Prepared for:

ANGOLA LNG

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1.0 INTRODUCTION

1.1 The Context, Scope, and Purpose of this Report

1.1.1 Introducing Angola LNG

The Angolan offshore Congo River Basin oil and gas deposits have been developed since the late 1970s. Historically, there has been no market for the natural gas, and any gas produced with the oil has been flared.

The need for a solution for the management of gas from oil and gas production offshore Angola emerged from the decision of the Angolan Government to enact a policy, coupled with the Partners' commitments to environmental and social responsibilities and responsible custodianship of hydrocarbon resources.

The goal of the Angolan Government's policy was:

- To restrict flaring of gas associated with oil.
- To require oil and gas operators to develop plans for monetization of gas associated with oil production and that all new oil development applications have a plan for gas utilization.
- To promote economic growth in Angola through the commercialization of gas associated with oil production.

The two key objectives of this policy and the Partner commitments are to protect the environment and to improve benefits for the country from oil and gas activities in Angola. In response to this a series of proposals for solutions for the management of gas were submitted to Sociedade Nacional de Combustiveis de Angola – Empresa Publica (Sonangol – the State Oil Company of Angola) by the oil and gas operators in 1997. The proposal from Texaco (now ChevronTexaco) promoting onshore LNG was selected as the preferred solution for the management of this gas, and Angola LNG was subsequently established.

In 1998, Texaco (now ChevronTexaco) signed a Joint Planning Agreement with Sonangol. This Agreement was subsequently reframed in April 2002 in order to accommodate new investors – BP, ExxonMobil, Total, and Norsk Hydro. Norsk Hydro withdrew from the project in June, 2003, leaving BP Exploration (Angola) Limited, Esso Angola Gas Company Limited and Total Angola LNG with respective shareholdings of 13.6% each. Under the reframed Agreement Cabinda Gulf Oil Company Limited (ChevronTexaco) and Sonangol were named as the Co-Leaders with shareholdings of 36.4% and 22.8% respectively.

The Angola LNG Project developed an opportunity statement based on the policy requirements of the Angolan Government for the management of this gas (see Box 1.1) in order to provide the basis for the process of identification and assessment of available options for the Angola LNG Project (see Section 4.0).

Box 1.1: Angola LNG Project Opportunity Statement

'To eliminate gas flaring through the development of a profitable, competitive, and integrated gas solution allowing the booking of reserves, timely oil development, and contribution to the social and economic development of Angola'.

The key objectives of this opportunity statement were to ensure that the Angola LNG Project resulted in:

- Protection of the environment through elimination of routine flaring of gas, thus restricting flaring to emergency and essential maintenance situations only.
- Commercialization of the gas.
- Promotion of economic growth in Angola.
- Opportunities for improvements in socioeconomic conditions in Angola.

Through the elimination of routine flaring of gas the project will result in significant reductions in greenhouse gas emissions from current oil production operations. Additionally, through the commercialization of the gas, the project will promote economic growth in Angola.

1.1.2 Project Standards and Commitments

Angola LNG is in the process of undertaking a program of studies and consultation and disclosure as part of an ESHIA (Environmental, Socioeconomic, and Health Impact Assessment) for the construction and operation of a Liquefied Natural Gas (LNG) plant and supporting infrastructure (see Section 2.2).

The ESHIA is part of an ongoing process in developing the overall Environmental, Socioeconomic, and Health Management Plan for the development and operation of the proposed project. The intent is to conduct this process consistent with World Bank Guidelines and relevant international industry guidelines; however, at the current time it is not anticipated that any funds or financial guarantees will be sought from the World Bank or any of its associated organizations. Additionally, the Project is committed to using the Energy and Biodiversity Initiative Tools (EBI) to make biodiversity conservation an integral part of the project.

The ESHIA will also:

- Meet the Angolan legislative requirements for the Environmental Impact Assessment (EIA) and related documents (see Section 2.0);
- Provide input to the Angola LNG Project team and design engineers to ensure an optimized design that minimizes environmental, socioeconomic and health impacts;
- Be thoroughly integrated, meaning that impacts and related mitigation measures for environmental, socioeconomic, and health aspects are coordinated; and
- Incorporate stakeholder input as the ESHIA studies are developed and executed and communicate successfully at key points to a wide range of stakeholders.

International standards that will be followed in executing the ESHIA are discussed in more detail in Section 2.0.

The Angolan EIA Regulations and the World Bank Policies require that the ESHIA be undertaken on behalf of the project sponsor by a suitably qualified independent consultant. Angola LNG has therefore contracted Environmental Resources Management (www.erm.com), an independent international consultancy firm, to undertake the ESHIA on its behalf.

1.1.3 ESHIA Scoping

Scoping is an important part of the ESHIA process since it allows a provisional identification of what are believed to be key issues. The ESHIA can then focus its efforts on these most important issues in terms of collecting information on existing conditions, engaging stakeholders, understanding the impacts and developing the measures to avoid or control and monitor them. It is important to note that this document presents the current views of the Angola LNG Project, based on past experience and professional judgment. The purpose of circulating this document and undertaking associated scoping consultations is to obtain third party inputs leading to a scope or Terms of Reference (TOR) for the full ESHIA that addresses the concerns and views of all parties to the extent this is practicable.

Angola LNG has produced this report and a separate non-technical summary of this report to support the consultation and disclosure program for the Scoping Phase.

These reports will be circulated to key stakeholders as a basis for consultation to identify the potential most important environmental, socioeconomic, and health impacts, which may have design implications and require project decisions. The potential impacts, in turn, will be the primary input for the preparation of the TOR

for the ESHIA for the Angola LNG Project. Comments and questions may be directed to the Angola LNG Project at:

Website: <http://www.angolalng.com>

Phone number in Luanda: 340 452 or 340 453

Phone number outside Luanda: 244-912-340-452 or 244-912-340-453

(Monday – Friday 8 am – 5 pm Luanda time)

Written Comments:

Angola LNG Project
Rua Guilherme Pereira Ingles No. 43 – 3 Andar – Fraccao A
Município da Ingombota
Luanda, Republica de Angola

All comments for the Scoping Phase of the ESHIA process must be received by June 20, 2005.

1.1.4 The Scope of this Report

This report presents the following:

- A description of the Preferred Project Alternative for the Angola LNG Project, highlighting the basis for the Environmental, Safety, Socioeconomic, and Health Philosophy and Policy (see Section 2.0).
- An overview of the ESHIA process, describing in particular the opportunities for stakeholders to influence the decision-making process for the Angola LNG Project (see Section 3.0).
- The proposed contents for the ESHIA (see Section 3.0).
- A summary historical record starting from the point at which the need for the Angola LNG Project was identified and continuing through the activities undertaken to identify the Preferred Project Alternative (see Section 4.0).
- A summary of the studies undertaken by the Angola LNG Project team to date to characterize the baseline health, environmental, and socioeconomic conditions for the footprint for the Preferred Project Alternative, and the initial findings of these (see Section 5.0).
- A summary of the gaps in the available data on the baseline health, environmental, and socioeconomic conditions and the activities required to address these gaps (see Section 5.0).

- A summary of the key potential health, environmental, and socioeconomic effects and the key project risks and opportunities identified by the Angola LNG Project team and the proposed mitigation measures (see Section 6.0).

The summary of the key impacts and project risks and opportunities and mitigation measures represents current views of the Angola LNG Project team, based on the extensive foundation of knowledge from the program of studies and consultation and disclosure undertaken to identify the Project Site, past experience, professional judgment and the current status of the engineering design process.

1.1.5 The Purpose of the ESHIA and this Report

Under Angola legislation the Angola LNG Project requires an EIA to be undertaken and submitted as part of the approval process. Throughout this document, reference will be made to the term ESHIA – Environmental, Socioeconomic, and Health Impact Assessment. This term has been chosen to reflect the fact that although Angolan legislation requires an EIA (Environmental Impact Assessment) to be undertaken (see Section 4.0), socioeconomic, socio-cultural, and community health and safety are also addressed as important elements of the Project. In a legal and procedural context, the Angola LNG ESHIA will meet all the requirements of Angolan legislation.

The Angola Ministry of Petroleum Regulation on Environmental Impact Assessment states that the EIA procedure includes the Environmental Impact Study, the Environmental Impact Assessment Final Report, and Public Consultation. Section 4.1 of this Scoping Phase Supporting Document describes the Project approval process and how the EIA and consultation fit into it.

Regardless of its role in the approval process it is also important to note that the ESHIA is a tool that can help project design and decision-making, by identifying impacts early so that mitigation options can be fully evaluated and incorporated into design.

The purpose of this report is to provide:

- The key potential environmental, socioeconomic, and health impacts and the key project risks and opportunities identified by the Angola LNG Project team and the way forward to address these proposed by the Angola LNG Project team.
- The available data and data gaps for the ESHIA process identified by the Angola LNG Project team and the activities proposed to fill these gaps.

The main objective of this report is to provide the appropriate information to enable stakeholders to participate in determining the Terms of Reference for the ESHIA.



The ESHIA is a tool that can help project design and decision-making by identifying impacts early.

2.0 THE ANGOLA LNG PROJECT

2.1 Introduction

The Angola LNG Project team has been responsible for implementing a rigorous preliminary evaluation program in order to identify the Selected Project Alternative and site location. The process and findings of this preliminary evaluation program are summarized in Section 4.0 of this report.

The preliminary evaluation program implemented by the Angola LNG Project team led to the selection of the Preferred Project Alternative as described in Section 2.2. A preliminary ESHIA was conducted for the project by the consulting firm ERM. This work was then fed into the Site Selection process to arrive at the best possible answer from environmental, socioeconomic, and safety perspectives.

The Angola LNG Project team has initiated a comprehensive engineering design process that will be integrated with the ESHIA process. The primary objective of these initiatives is to optimize the project design so that associated potential environmental, socioeconomic, health, and safety impacts are either eliminated or minimized and the associated beneficial opportunities are identified and integrated.

An overview of the current understanding of the components of the Preferred Project Alternative based on engineering design work in progress at the time of writing is presented in Section 2.2.

An overview of the interactive engineering design process is provided in Section 2.3.

2.2 The Selected Project Alternative

2.2.1 Overview of the Selected Project Alternative

The Angola LNG Project concept involves the collection of associated gas from oil production facilities operating offshore Angola, and transportation of this gas to onshore gas treatment and Liquefied Natural Gas (LNG) process facilities.

The LNG process facilities will convert the gas into a liquid and store it for future delivery for export via tankers. The process of conversion of the gas to a liquid, referred to as cryogenic liquefaction, involves alternating pressurization and cooling and ultimate decompression of the gas in order to reduce the temperature to a point at which the gas condenses to form a liquid.

The LNG plant will produce LNG, liquefied petroleum gas (LPG) and gas condensate for export. In addition, a supply of natural gas (75MMCF/day) will be available from the processing plant for use within Angola as determined by Sonangol and the government of Angola.

A marine terminal will be required to handle the berthing and loading of tankers and a shipping channel and turning basin of sufficient depth and width will be required to accommodate the tankers.

The initial supply of gas for the LNG plant will come from associated gas in existing oil producing facilities in License Blocks 0 and 14 (operated by Cabinda Gulf Oil Company Limited), 15 (operated by Esso Exploration Angola Limited), 17 (operated by Total Exploration and Petroleum Angola), and 18 (operated by BP Angola BV). Future developments currently planned include non-associated gas (NAG) production facilities (to be operated by Angola LNG in the future) in License Blocks 1 and 2 offshore Angola (see Figure 2-1).¹ Other gas sources may also be considered in the future.

In order to gather gas from the License Blocks and deliver it to the onshore LNG Plant, the Angola LNG Project will involve the development of a gas gathering pipeline system linking existing offshore facilities in the License Blocks to the onshore LNG Plant.

Permanent onshore supporting facilities, including offices and residential housing and associated recreational and service infrastructure will be required. Support facilities including a workers camp, laydown area and dock will also be required during the construction phase. A participatory needs assessment is being conducted for the area affected by Angola LNG to help determine which of these facilities should be temporary or permanent. Additional studies are being conducted to help determine the need for upgrading the onshore transport infrastructure such as roads and bridges for use by the Angola LNG Project during construction and operation activities.

2.2.2 The Selected Project Alternative

The Selected Project Alternative involves location of the onshore facilities on the south bank of the Congo River on the northern shoreline of Kwanda Island in the Soyo Municipality of the Zaire Province of Angola (see Figure 2-2). This location has previously been referred to, during the program of studies and consultation and

¹ Associated gas comes from wells which produce gas and oil. Non-associated gas comes from wells which generate primarily gas.

disclosure undertaken to support the selection of the location, as the 'Best Shipping Alternative' (see Section 4.0).

The proposed footprint for the onshore gas reception and treatment, LNG process and storage facilities, and associated marine terminal is shown in Figure 2-3. The proposed locations of the infrastructure dock, marine base and a laydown area are also indicated in Figure 2-3.

Specifically Figures 2-2 and 2-3 illustrate the following key aspects of the Selected Project Alternative:

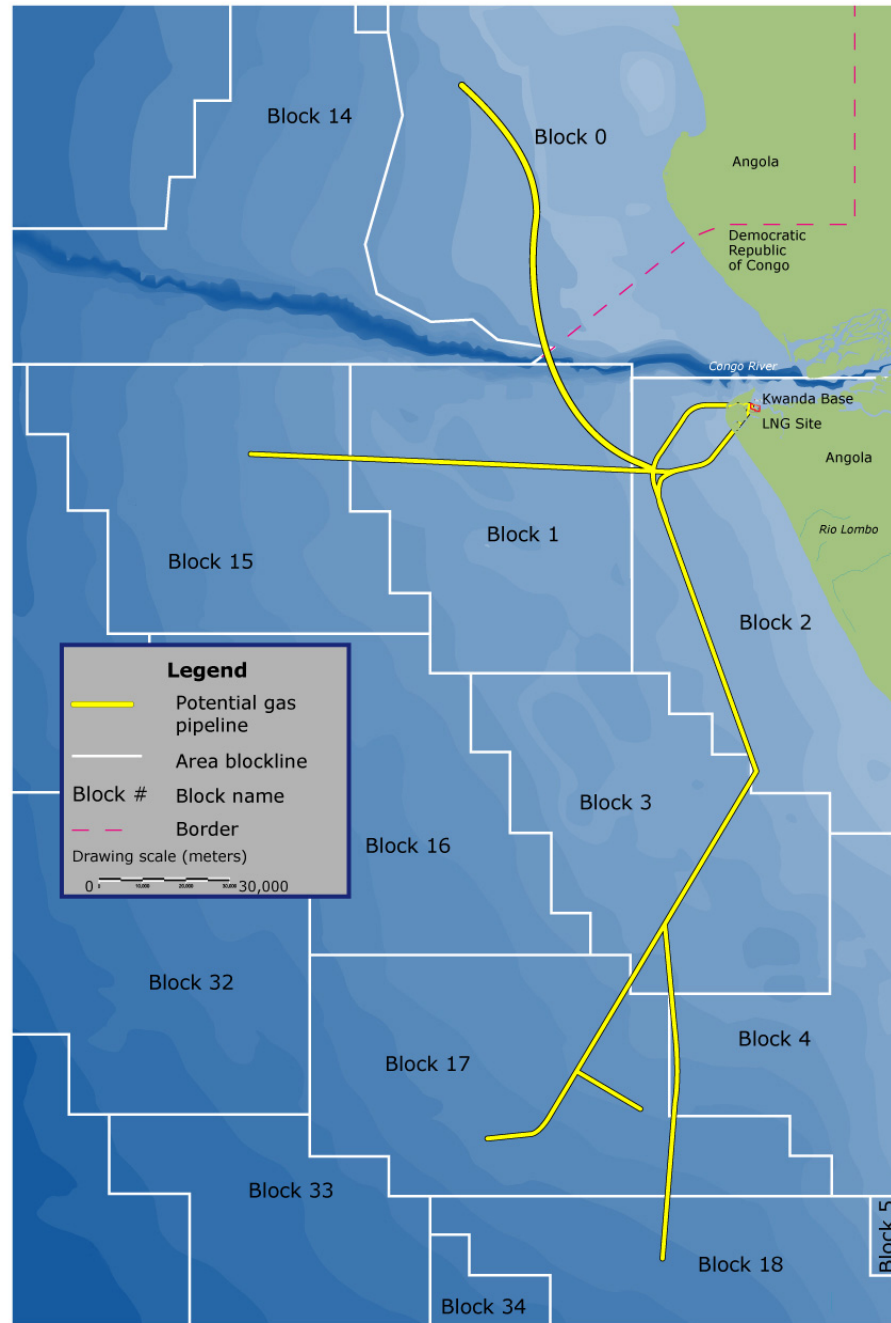
- The proposed footprint, including a laydown area, will occupy approximately 252 hectares (ha) including reclaimed land, existing land, and over water (see Figure 2-3).
- The marine terminal will be located at the northern shoreline of the land reclamation area in Baía Diogo Cão. The marine terminal will comprise two dedicated marine berths, one for LNG only and one for LPG and condensate. These berths will be located approximately 1,000 m from the nearest facilities on Kwanda Base and will occupy approximately 15 ha (see Figure 2-3).
- The marine terminal will be served by an approximately 14 m deep and 250 m wide approach channel, constructed by widening and deepening the existing shipping channel from Ponta do Padrão to Kwanda Island and the new dedicated turning basin (see Figure 2-2).
- An infrastructure dock will be located to the west of the plant site, immediately adjacent to and north of the existing commercial jetty at Kwanda Base. A newly constructed road will connect the infrastructure dock with the LNG plant site (see Figure 2-3). It is planned that the infrastructure dock and road will be available for use by other commercial enterprises in the Soyo area.
- A construction dock/marine base dock will be located to the east of the plant site. This dock will serve as the main dock to be used during construction and will be converted after construction into a permanent marine base for the accommodation of tugboats, customs office, and other related maintenance shops.
- A construction workers camp is anticipated to be located to the southeast of the LNG e which will be restored or reused after construction is completed.

Figures 2-2 and 2-3 do not show the locations of the permanent supporting facilities such as offices, residential housing and associated service infrastructure as the locations of these have not yet been determined. These figures also do not



show all roads and pipelines associated with the Angola LNG Project. A number of options are currently being considered and evaluated for the routing of these facilities.

Figure 2-1: Natural Gas Resources

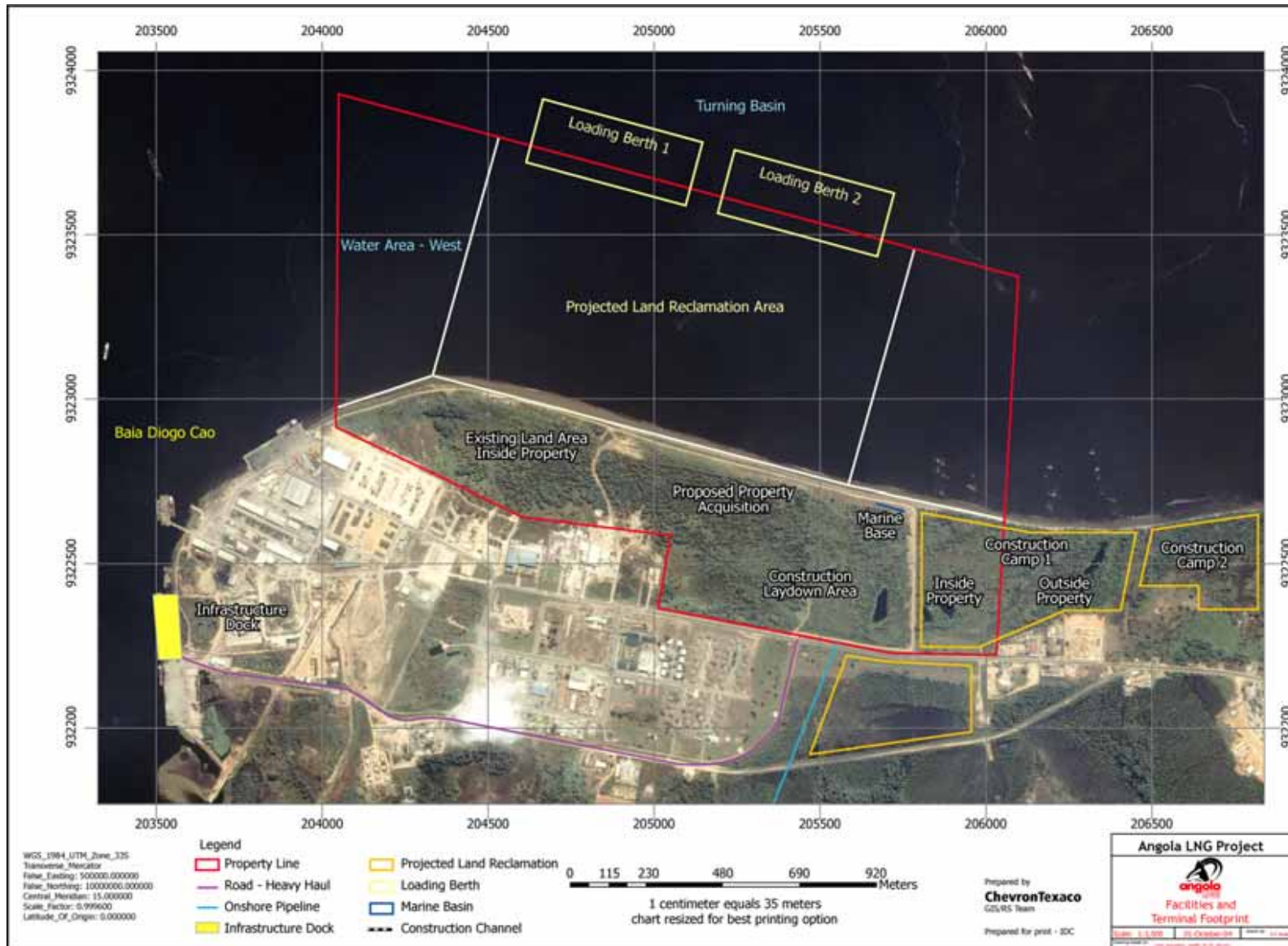


Note: This schematic of potential gas pipeline routes is for illustrative purposes only. The actual pipeline routes will only be determined after all environmental and geotechnical considerations are fully evaluated.

Figure 2-2: Selected Project Alternative and Turning Basin



Figure 2-3: Selected Project Alternative Onshore Facilities and Marine Terminal Footprint



2.2.3 The Angola LNG Project Design, Construction & Commissioning Schedule

The estimated duration of the design, construction and commissioning of the Preferred Project Alternative is approximately 5 years based on a scheduled initial start-up for the Angola LNG Project facilities in 2010. However, this initial start-up timetable includes only partial construction of the offshore gas collection pipeline system (see Figure 2-1).

The first phase of the construction program will be the preparatory works comprising dredging of the channel, land reclamation and infrastructure improvements such as housing, water and sanitation supply, warehouses, medical facilities, road improvements and docking facilities. The preparatory works are scheduled to commence in late 2005/early 2006 for a period of 18 months.

The construction program for onshore Angola LNG Project facilities is scheduled to commence in 2007 for a period of 42 months.

The construction and commissioning of the offshore gas collection pipeline system will be phased over several years. The first phase will be completed to ensure an available gas supply for the initial start-up of the LNG plant in 2010.

A tentative timeline for the construction program will be developed by the engineering design team in collaboration with the environmental consultant so as to eliminate or minimize potential adverse environmental, socioeconomic, and health risks and impacts, and to optimize positive impacts and beneficial opportunities. The project team will have the final approval on the construction timeline.

2.2.4 Program of Preparatory Works & Construction

2.2.4.1 Introduction

The program for preparatory works and construction for the Angola LNG Project will involve a process that will be undertaken by means of multiple, separate contracts.

An overview of the scope of the preparatory works highlighting the current status of the engineering design work is provided in Section 2.2.4.2.

The facility construction program will comprise the following main components:

- Construction of the LNG process facilities and marine terminal, and supporting infrastructure.

- Construction of offshore pipelines north and south of the Congo River including connection to existing offshore platforms, deepwater and shallow water installation, crossing of the Congo River, and construction of pipeline landfall and onshore component.

These components of the construction program are described in more detail in Sections 2.2.4.3 and 2.2.4.4 with reference to the current status of the engineering design work.

2.2.4.2 The Preparatory Works

The scope of the preparatory works encompasses the following:

- Dredging (both deepening and widening) of the existing shipping channel from Ponta do Padrão to Kwanda Island to accommodate the deeper draft ships and provide a turning basin for the safe arrival and departure of the tankers to and from the proposed marine terminal (see Figure 2-2).
- Land reclamation in the shallow waters north of the existing Kwanda Base to create the northern portion of the site. The reclaimed area will comprise a parcel of land extending from the existing Kwanda Island approximately 750m out into the Baía Diogo Cão (see Figure 2-3).
- Local infrastructure improvements comprising construction of a new infrastructure dock (on the west side of Kwanda Peninsula near entrance to Pululu Channel), a construction dock/marine base, a new road, and potential additional transport infrastructure improvements.
- Site clearing activities, including clearing of unexploded ordnances (UXO).

Dredging - The existing shipping channel that currently serves Kwanda Base is 7 to 8 m deep and approximately 80 m wide. This channel is dredged periodically (maintenance dredging) to maintain the water depth, and the dredged materials are disposed in the Congo River Canyon area. Movement of the deeper draft tankers to and from the planned LNG marine terminal will require creation of a deeper and wider shipping channel and associated turning basin. The existing shipping channel from Ponta do Padrão to Kwanda Island will be dredged and widened to create a channel that is estimated to be 14 m deep and 250 m to 300 m wide. Dredging activities will produce an estimated 30 to 40 million m³ of dredged materials. Geochemical testing of the shallow sediments has been performed, to ensure compliance with London Dumping Convention Guidelines for its disposal in the Congo River Canyon area. Additional geochemical testing is underway to confirm that this material and the deeper sediments would also be suitable for use as construction fill for land reclamation. Any excess dredged materials may be disposed in the Congo River Canyon area or considered for utilization as land fill

in other areas if the material is suitable and needed. Spoils from maintenance dredging of the existing ship channel are currently disposed in the Congo River Canyon area as a normal practice.

Land reclamation - The land reclamation activities will be undertaken in the nearshore area of the Baía Diogo Cão immediately north of the Kwanda Base where the water depth is relatively shallow (approximately 2 to 3 m). This situation significantly reduces the required fill volumes. It is estimated 10 to 12 million m³ of fill will be required in the nearshore reclamation area to form the required reclaimed area. As noted above, it is intended to use the material from the dredging activities, assuming that it is confirmed to be suitable, as the source of the fill material. Should dredging operations not produce sufficient quantities of suitable fill material, alternate sources will be located and utilized.

Preliminary engineering evaluations related to the dredging and land reclamation components of the project have recently been initiated. The focus of these evaluations is the assessment of alternative dredging and land reclamation techniques and development of plans for mitigation of potential coastal erosion, turbidity, and/or sedimentation impacts on the shoreline and marine environment. These will be fully developed during the engineering design process. The bathymetric, hydrodynamic, geotechnical, and geochemical evaluations of the offshore area in the vicinity of the planned dredging/land reclamation site are also in the initial stages. When completed, they will provide the information needed to design and implement dredging and land reclamation activities that incorporate best management practices to eliminate or minimize potential impacts to the marine and nearshore environment.

Infrastructure improvements: The preparatory works will also include several improvements to regional infrastructure such as a new infrastructure dock and a road, as well as other improvements that are currently under evaluation (see Figure 2-3). The infrastructure dock and road are intended to serve the Soyo area by providing a heavy load (deep water) unloading dock and a heavy load haul road that is connected to the main Kwanda Base road. Endeavors will be made to schedule the construction of the dock and the road to make it available for use in support of the land reclamation phase of the project. Since most of the construction equipment and materials will arrive by sea, preliminary site work will also include building a construction dock. This dock will be located near the construction lay down area and will be designed to accommodate the heavy loads associated with offloading of construction material and equipment. It is anticipated that this dock may also serve as a permanent docking facility and converted to a marine base to be used by support vessels (e.g., tugboats) during the operation of the LNG marine terminal facility.

Other infrastructure improvements are also under consideration and will be identified during the ongoing iterative engineering design process.

Site Clearing: Initial site preparation activities will include clearing of the existing land area, grading, and leveling the site. The construction of a temporary surface water drainage system and construction of temporary construction access roads will follow. Prior to construction, the Angola LNG Project team will engage the services of a specialized company for the removal of unexploded ordnance (UXO).

For the preparatory works, the use of local Angolan workers will be optimized. This will be facilitated through the prior identification of skills and training needs and the provision of appropriate training as required. Some specialist workers will need to be recruited from outside of Angola. It is anticipated that many of these non-local workers will live onboard marine vessels. However, if necessary, a small, self-sufficient temporary construction work camp (with independent potable water and wastewater treatment facilities) will be established to house non-local employees. The location and need for this will be determined during the ongoing engineering design process.

2.2.4.3 The Construction Program for the LNG Process Facilities & Marine Terminal & Supporting Infrastructure

The construction program for the LNG process facilities and marine terminal, and supporting infrastructure will include:

- Construction of construction work camps and associated infrastructure.
- On-site civil construction including roadways, building foundations, tank foundations, pile installation (if required), etc.
- Civil/mechanical/electrical construction of LNG process facilities including gas inlet and treatment facilities, LNG liquefaction facilities, LPG fractionation facilities, condensate facilities, and associated refrigeration/storage facilities.
- Construction of the marine terminal and associated LNG, LPG, and condensate transfer equipment.
- Construction of associated support facilities such as power generation units, water and wastewater treatment facilities, etc.

Construction camp: An approximate 11 ha parcel of land has been set aside for the construction of a worker camp. The number, type and skill levels of the construction work force will vary over the course of the construction project, and the use of local Angolan workers will be optimized. The criteria for who will be

housed in the planned construction camp will be determined as the project progresses.

Civil Works: The civil construction activities including permanent roadways, building foundations, tank foundations, and other major scale civil construction will start after the site clearing. Geotechnical evaluations will be performed to determine the need for pile-support for the various foundations and structures. Civil construction will be followed by other civil/mechanical/electrical construction of the various LNG process facilities and supporting permanent structures.

Marine Terminal: Construction of the marine terminal facility will involve certain additional activities in the shoreline area of the newly reclaimed site. Construction of the tanker jetties and the marine and process flares will be accomplished using a combination of land-based and marine-based construction equipment.

Support Facilities: Support facilities such as diesel-fired power generating facilities, technical/process and potable water supply/treatment systems, technical/process and sanitary wastewater treatment/discharge systems, and associated storage units (fuel oil storage tanks, potable water storage tanks, etc.) will be constructed at or in the direct vicinity of the project site. Several options are being considered for water supply for the construction site. An impact assessment will be conducted to determine the best means for collection, treatment and appropriate handling of construction site wastewater that may include discharge. A qualitative risk assessment process will be used to determine the feasibility and appropriateness of the options prior to selection and take into account the relevant guidelines and standards adopted by the project.

A concrete batch plant will be constructed within the project site footprint to produce the concrete required for the various building and tank foundations. It is anticipated that this plant will have independent water treatment and wastewater treatment facilities to ensure that the concrete produced by the plant will meet required quality standards and that any potential water discharges from the plant are of an acceptable quality and discharged in an appropriate location.

Personnel support infrastructure will also be constructed at the construction worker campsite. This includes water supply/treatment systems, sanitary wastewater treatment/disposal systems, and diesel-fired power generation facilities at the construction worker camp. are expected to be similar to those constructed at the project site. Evaluations are planned to determine if this infrastructure will be temporary or permanent.

The Angola LNG Project team is evaluating alternatives for the construction of permanent worker facilities (housing and support facilities) for the use of

employees and guests during the operational phase of the project. The permanent residential housing will be constructed to serve up to 300 residents.

2.2.4.4 The Construction Program for the Offshore Gas Gathering Pipeline System

Preliminary routes for the proposed offshore gas gathering pipeline system to be constructed in support of the Angola LNG Project are shown in Figure 2-1. It is expected that multiple pipelines will be constructed; however, the final number of lines coming to shore may vary, depending on whether a hub structure is constructed offshore to combine flows from two or more lines. Final decisions on pipeline diameters have not yet been made, however, it is expected that most pipelines will be in the 30 cm to 55 cm (12” to 22”) diameter range. If a hub platform is used, the large pipeline transporting the combined flow from the various platforms could be approximately 75 cm (30”) diameter.

Conventional methods are expected to be used for the construction and installation of pipelines in the deepwater offshore areas. Several options are being considered, and the preferred option will depend on the size of pipe and the lay barges that are available during the construction time frame. For the Congo River Crossing, the well intersection method (WI) and Bottom Founded Trench (BFT) method are being considered. For WI, two semi submersibles will be used to install the pipe. For the BFT, a barge or barges will be used. Each offshore lay barge will have between 100-200 persons on board. The barge personnel will reside on the barge during the work period and will not require onshore housing.

In shallower water, various options are still under consideration for the onshore/nearshore pipeline sections. Appropriate methods will be developed for the selected option.

Several methods of pipeline landfall have been evaluated. Presently for the landfall construction, the preferred method is horizontal directional drilling (HDD). However, no final decision has been made and other methods will be looked at during front end engineering and design (FEED) before a final decision is made. If HDD is used, this would be done from the shore where possible or from a barge where it is not. It is expected that HDD will be used to “stitch” the pipeline through and beneath sensitive resource areas to avoid damage to sensitive resources.

Pipeline construction will likely take place over the course of several years under a series of separate construction projects.

2.2.5 Operation of the Project Facilities

2.2.5.1 The LNG Process Facilities

The LNG facility will receive associated gas (AG) and multi-phase non-associated gas (NAG) from offshore platforms. The raw gas will undergo pre-treatment to remove acid gas (CO₂ and H₂S), water (dehydration), and mercury. The treated and dehydrated gas stream will then be routed to a liquefaction unit in which it will undergo multiple stages of chilling, with each sequential stage subjecting the gas stream to a lower temperature and pressure. The product from the final chilling stage will be LNG, which will then be transferred to an LNG storage tank for storage prior to export. During the chilling processes (including dehydration and liquefaction), heavy hydrocarbons liquids (unstabilized condensate streams) will be removed from the system and will be routed to the LPG and condensate separation system (LPG fractionation unit), producing propane, butane and stabilized condensate. The LPG will be transferred to dedicated tanks for storage prior to export.

It is anticipated that conventional acid gas removal, dehydration and mercury removal systems will be utilized. The engineering design process will involve assessment of available options (see Section 2.3).

There are two proposed liquefaction processes under consideration:

- The Air Products and Chemicals, Inc. (APCI) propane pre-cooled mixed refrigerant process (often referred to as C3-MR).
- The ConocoPhillips Optimized Cascade Refrigeration Process.

As noted above, each of these processes involves multiple sequential chilling stages. The APCI C3-MR process uses two cooling stages. The first stage uses propane (C₃H₈, thus the “C3” nomenclature) as a cooling fluid and the second stage uses a “mixed refrigerant” of ethanol, propane, methane and nitrogen to further cool the gas stream and produce LNG. The ConocoPhillips process uses a three-stage chilling process that sequentially uses compressed propane, ethylene, and methane as cooling mediums.

The refrigeration cycles for each of these liquefaction processes are expected to require the use of multiple compressors, each likely served by a dedicated gas fired combustion turbine. As such, the liquefaction processes will represent a significant component of the overall LNG facilities air emissions inventory. Similarly, compressors and combustion turbines will generate a significant heat load. Cooling systems (air or water) will be required to dissipate the heat load.

A typical fractionation process involves multi-stage heating and cooling of the LPG, sequentially removing the individual LPG components by distillation. The lightest product (ethane) is typically removed in a “de-ethanizer” unit. The heavier products, including propane, are then removed in a “de-propanizer” unit. After fractionation, the gases (butane and propane) will be cooled and pressurized to produce LPG and will be stored in dedicated refrigerated tanks. The fractionation facility will have heating, cooling, and compressor demands and, similar to the liquefaction facility, will have air emissions associated with combustion turbines and will need to reject heat.

The LNG facility will require support facilities including power generating facilities, water supply/treatment facilities, process and sanitary wastewater treatment facilities, and possibly cooling water intake/discharge facilities (although air cooling is the most likely alternative). Details of these facilities are not available at the time of preparation of this report. It is expected that power-generating facilities will include one or more natural gas-fired combustion turbines and likely a diesel fired combustion turbine (for startup and as emergency backup). A water supply source has not been identified yet. Options include a surface water source or groundwater and would likely require some type of filtration, desalination and disinfection process. Evaluations are ongoing to identify appropriate handling of the reject water and treated waste water, which may include discharge after treatment. An impact assessment will be conducted to determine if discharge is appropriate. The sanitary wastewater treatment system is expected to include biological treatment and disinfection. The design of the process wastewater treatment system will be a function of the waste streams and will likely involve some type of oil/water separator and possibly pH adjustment (neutralization).

The facility will have some ground-level flares that will be situated at the perimeter of the reclaimed area. The purpose of these flares will be to safely handle any process upsets, emergencies, and excess gas volumes during startup.

Approximate facility specifications have been determined by the Angola LNG Project team. These include:

- LNG storage tank(s)
- Liquid propane storage tank(s)
- Liquid butane storage tank(s)
- Condensate storage tank(s)
- Natural gas supply pipeline (at battery limits of site) with a 75 million standard cubic feet per day (MMscfd) sendout.

The LNG, propane and butane tanks will be, as a minimum, of a double-containment design. The specific location of these storage tanks and other LNG process facilities on the project site will be identified at the completion of the FEED.

2.2.5.2 Marine Terminal Facilities

Two ship-berths will be constructed as part of the marine terminal facilities. Each berth will be dimensionally and structurally designed to accommodate LNG tankers and a minimum water depth alongside of minus 14 meters as measured at low astronomical tide (LAT). The actual size of the LNG tankers to be used here is yet to be decided. The berths shall be capable of handling smaller tankers as required.

One berth will be dedicated to handling LNG tankers, while the second berth will be primarily used for the loading of LPG (butane and propane gases) and condensate product as applicable.

Loading operations may be conducted simultaneously at the two separate berths once the tankers are safely moored. However, only one ship at the time will be allowed to move to/from the berths.

Loading of LNG and LPG products will be conducted using multiple loading arms and at least one vapor return line to allow vapors to flow back into on-shore storage tanks.

Ships will be required to maintain all times readiness status for immediate departure while moored at either of the berths.

2.3 The Alternative Engineering Design Process

2.3.1 Introduction

Separate contracts will be held by international engineering and construction firms for each aspect of the work, namely the preparatory work, the LNG process, marine terminal and supporting facilities and the offshore gas collection pipeline system respectively. In addition, the gas collection pipeline system work will be further subdivided by segment.

The engineering teams for each component of the Angola LNG Project will be required to work in close collaboration with the ESHIA consultant and specialists within the Angola LNG Project team in order to ensure that the facilities design eliminates or minimizes environmental, socioeconomic, health, and safety effects and the associated beneficial opportunities are identified and integrated.

In order to facilitate this collaboration, the engineering design process that will continue to further develop the project conceptual design as outlined in Section 2.2 will be undertaken in parallel with the ESHIA process (see Section 3.0).

The Angola LNG Project team is in the process of developing an Angola LNG Project Health, Environment, Socioeconomic, and Safety Policy, Environmental Design, Philosophy, and Functional Specifications (see Section 2.3.2). These will provide the engineering design teams with the necessary guidance and reference standards for the elimination or minimization of environmental, socioeconomic, health, and safety impacts.

In addition, the Angola LNG Project team has developed a design justification process that requires the engineering design teams to implement a rigorous program to evaluate design options against a set of criteria that includes environmental, socioeconomic, and health aspects, and stakeholder views (see Section 2.3.3).

2.3.2 Angola LNG Project Policy and Philosophy

2.3.2.1 The Development Process

The Angola LNG Project team is developing its Health, Environmental, Socioeconomic, and Safety Policy. One of the preliminary steps in this process was the development of the Angola LNG Project Team Vision (see Box 2.1). The commitment contained in this Vision statement together with the stated core values regarding people, safety, environment, and health, provides the basis for the definition of guidance and reference standards for the development of the Angola LNG Project Health, Environmental, Socioeconomic, and Safety Policy.

Tables 2.1 and 2.2 (see Section 2.3.2.2), present an overview of national and international guidance and reference standards identified as potentially relevant for the development of the Angola LNG Project Health, Environmental, Socioeconomic, and Safety Policies. Relevant portions of these standards are also being used to develop goals, requirements, commitments, objectives, targets, and practices that reflect the commitment to responsible development with respect to safety, environmental, and social issues.

In addition to the reference guidance and standards presented in Tables 2.1 and 2.2, the Angola LNG Project team will draw on the statements contained in the Angola LNG Project team Vision and on the Corporate Health, Environmental, Socioeconomic, and Safety policies and commitments and business ethics values of the Angola LNG partners (namely ChevronTexaco, Sonangol, BP, Exxon Mobil, and Total). The team will also undertake benchmarking against other similar projects.

Box 2.1: Project Team Vision

We are recognized & respected by our investors, hosts and customers for delivering a World Class LNG enterprise that is known for its innovation and sustainable solutions in facilitating Angola's hydrocarbon development.

We are recognized and respected for our core values regarding people, safety, environment and health:

- Every Person – Safe - Every Day
- Transparent & Ethical Behaviour
- Positive Social Contribution
- Proactive and Decisive Leadership
- Strong Capability in Health, Environment, Safety, Reliability, and Efficiency

Date: 16 June 2004

Endorsed by: Angola LNG Project Management Team

The Angola LNG Project has already adopted ChevronTexaco's Operational Excellence Policy (www.chevrontexaco.com) as the initial model for development of the Health, Environmental, Socioeconomic, and Safety Policies, Design Philosophy and Functional Specifications. The ChevronTexaco Operational Excellence Policy incorporates an Incident and Injury-Free (IIF) vision that promotes a mindset that is intolerant of any level, frequency or severity of incident or injury. IIF is founded upon a shared set of beliefs, respect for others, supportive and participatory mannerisms, and the wellbeing of one's self and colleagues, rather than numbers and statistics. It is more than operational disruptions and equipment outages; more than mere compliance with standards and policies; more than an attempt to avoid punishment—it is value-based and not a trade-off with cost and/or schedule.

In addition, the Angola LNG Project team has completed the Environmental Design Philosophy and has committed to the following preliminary set of Health, Environmental, Socioeconomic, and Safety and Business Ethics Objectives:

- Ensuring the Project achieves excellence in safety and environmental performance.
- Developing and creating an Incident and Injury-Free safety culture.
- Providing HES guidance and direction to all project workers during all phases of the Angola LNG Project.

- Ensuring all procedures, processes, activities, and records are in full compliance with all applicable HES laws and regulations.
- Ensuring the Project is consistent with appropriate industry and international HES standards, including World Bank Guidelines and Policies.
- Designing the new facilities so they conform to relevant industry design standards.
- Contributing to the development of Angolan regulations to provide consistency with international and industry standards and best practice.

2.3.2.2 Reference Guidelines and Standards

The Angola LNG Project will be in compliance with the statutory requirements of Angola. To this end the reference standards and guidance include both Angolan legislation and international standards and guidance (see Tables 2.1 and 2.2, respectively).

National Standards and Guidelines

Angolan laws and regulations address various aspects of the human and natural environment, including environmental protection, land ownership, and resettlement. The key statutes and the related requirements are summarized in Table 2.1.

Environmental protection measures are contained within Angola's constitution and the General Environment Law. There are no specific technical standards yet developed for protection of environmental media (e.g. air quality, water quality, etc.) applicable to the Angola LNG Project; current measures are focused on regulating upstream hydrocarbon activity.

The Angolan Land Law 09/04 of November 9, 2004 grants citizens access to land and the right to use it. Prior to the enactment of the land law, the Angola legislation only covered surface land rights. However, the land law regulates all land rights. The legislation establishes the basis for the property regime, land ownership and various types of land occupation. Under the land law, land is basically owned by the State and it may be made available for 'useful and effective' purposes. The land law is also intended to ensure respect for traditional land rights of the population that are protected by the Constitution of Angola. In any case, the site selected is currently underutilized relative to other site options and will in fact be adding usable land through partial reclamation of the bay.

Table 2.1: Key National Legislation

Regulation	Key Aspects
Environmental Protection	
Angolan Constitution, Article 12	The State shall promote the protection and conservation of natural resources guiding the exploitation and use thereof for the benefit of the community as a whole.
Angolan Constitution, Article 24	All citizens shall have the right to live in a healthy and unpolluted environment. The State shall take appropriate measures to protect the environment and flora and fauna species to maintain ecological balance. Acts that damage or directly or indirectly jeopardize conservation of the environment shall be punishable by law.
General Environment Law 1998, Law 5/98	This law contains general standards that require regulation in order to be applied in practice, which are complemented by various international conventions ratified by Angola. This law establishes the principle of strict liability for environmental offences. This law also establishes the requirement for major activities in Angola to be subject to Environmental Impact Assessment (EIA) and sets out general requirements.
Impact Assessment	
Decree 39/00 on Environmental Protection for the Petroleum Industry (PIEFD)	This decree is administered by the Ministry of Petroleum and sets out specific EIA requirements for the petroleum industry following the framework requirements set out in <i>General Environmental Law 5/98</i> .
Decree 51/04 on Environmental Impact Assessment - Council of Ministers	This decree provides the content and structure of the EIA, including consultation, approval procedure, time frame, roles of regulators and issuance of permits.
Land Use and Resettlement	
Angolan Constitution, Article 12	Land belonging to the State may be transferred to individuals or corporate bodies in accordance with the law. The Constitution provides that the State will respect and protect the property and ownership of land, owned by individuals or corporate bodies, without prejudice to the possibility of expropriation in the public interest.
Land Law 09/04 (November 2004)	This law establishes the general basis for the legal system regulating land owned by the state, including the rules for establishment, transfer, exercise and lapse of property rights. The law reinforces the constitutional principle that the land belongs to the State. The State may transmit or constitute property rights on land falling under its private domain. However, the State cannot transmit the right to explore for minerals, so mining rights are still inalienable. The basic principle which governs the Draft Land Law is that the State may transmit the property or constitute property rights over the land, but, it does not imply acquisition by accession or any other manner of any right over natural resources.

Regulation	Key Aspects
Decree No. 1/01 and Decree No. 79/02	Provincial Governments are empowered to schedule, organize and ensure the execution of all the processes related to the return and resettlement of displaced people. Each family being resettled should be awarded half a hectare of cultivable soil without payment. Resettlement areas must have sufficient space for the construction of shelters.

International Standards and Guidelines

Angola is signatory to various international treaties, conventions and protocols. These relate to such issues as biodiversity, climate change, marine pollution, social justice and human rights. A non-exhaustive list of international conventions, treaties, and protocols is presented in Table 2.2.

International organizations such as the World Bank and International Finance Corporation (IFC) have environmental and socioeconomic guidelines and standards that relate to both conducting an EIA (or ESHIA) as well as to the technical performance standards of the Project. It is the intention of the project to meet or exceed these standards. World Bank and IFC requirements are summarized in Table 2.2.

International best practice has also been established through a variety of other guidance documents. This guidance derives from the oil and gas industry itself, as well as various NGOs. The Project will demonstrate best practice in relation to a number of voluntary guidelines including those relating to biodiversity, human rights and social welfare. A non comprehensive summary of these standards and guidelines is provided in Table 2.2. The Project is committed to conform with the intent and spirit of these standards and guidelines, fully recognizing that many specific recommendations within these guidelines are reserved for Government action not industry. The Project will work in partnership with Government, communities and others to address relevant and applicable specific recommendations from these standards and guidelines.

The Angola LNG Project will develop a comprehensive management plan and commitment matrix that will be the bases for monitoring of activities and adherence to the commitments of the project throughout its lifecycle.

Table 2.2: Key International Legislation, Regulations and Guidance

Organization	Item	Comment
International Treaties, Conventions and Protocols		
ENVIRONMENT, HEALTH AND SAFETY		
International Maritime Organization	International Convention for the Safety of Life at Sea (SOLAS), 1974	The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment, and operation of ships, compatible with their safety. Flag States are responsible for ensuring that ships under their flag comply with their requirements, and a number of certificates are prescribed in the Convention as proof that this has been done.
International Maritime Organization	International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)	The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations. It comprises several annexes dealing, inter alia, with oil, sewage, solid wastes, ballast water, emissions, etc.
International Maritime Organization	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969	The Convention affirms the right of a coastal State to take such measures on the high seas as may be necessary to prevent, mitigate or eliminate danger to its coastline or related interests from pollution by oil or the threat thereof, following a maritime casualty. The 1973 Protocol extended the Convention to cover substances other than oil, but Angola did not sign the 1973 Protocol.
International Maritime Organization	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, London Convention, 1972	The Convention has a global character, and contributes to the international control and prevention of marine pollution. It prohibits the dumping of certain hazardous materials, requires a prior special permit for the dumping of a number of other identified materials and a prior general permit for other wastes or matter. Angola also signed the 1996 Protocol, which is much more restrictive.
International Maritime Organization	International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990	Ships are required to report incidents of pollution to coastal authorities, and the convention details the actions that are then to be taken. The convention calls for the establishment of stockpiles of oil spill combating equipment, the holding of oil spill combating exercises and the development of detailed plans for dealing with pollution incidents. Parties to the convention are required to provide assistance to others in the event of a pollution emergency, and provision is made for reimbursement of any assistance provided.

Organization	Item	Comment
International Maritime Organization	International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND), Protocol 1992	The 1992 Protocol established an International Oil Pollution Compensation Fund, known as the 1992 Fund, to be subscribed to by the cargo interests, which would be available for the dual purpose of, on the one hand, relieving the ship owner of the burden by the requirements of the new convention and, on the other hand, providing additional compensation to the victims of pollution damage in cases where compensation under the 1969 Civil Liability Convention was either inadequate or unobtainable.
Organization of African Unity	Bamako Convention (1991)	The Convention, affirming a commitment to address the problem of Hazardous Wastes in Africa, bans the import into Africa and the control of transboundary movement and management of hazardous wastes within Africa.
SOCIOECONOMIC		
United Nations	Universal Declaration of Human Rights	<p>International Law providing for a common standard of achievement for all peoples and all nations to strive for through teaching and education. The law also provides for the promotion of respect for these rights and freedoms and for progressive national and international measures to secure the effective recognition and observance of these among peoples of signatories themselves and among the territories under their jurisdiction. Key provisions include:</p> <ul style="list-style-type: none"> • Article 19: Everyone has the right to freedom of opinion and expression, this includes freedom to hold opinions without interference and to seek, receive, and impart information and ideas through any media regardless of borders. • Article 20: (1) Everyone has the right to freedom of peaceful assembly and association. (2) No one may be compelled to belong to an association • Article 23: (1) Everyone has the right to work, to free choice of employment, to just and favorable conditions of work and to protection against unemployment (2) Everyone who works has a right to just and favorable remuneration ensuring for his/her and his/her family an existence worthy of human dignity and supplemented, if necessary, by other means of social protection (4) Everyone has the right to form and to join trade unions for the protection of his/her interests. • Article 24: Everyone has the right to rest and leisure, including reasonable limitation of working hours and holidays with pay.
United Nations	Global Compact Principles	Human Rights: Businesses should support and respect the protection of internationally proclaimed human rights within their sphere of influence, and ensure that they are not complicit in human rights abuses.

Organization	Item	Comment
		<p>Labor Standards: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining; the elimination of all forms of forced labor and compulsory labor; the effective abolition of child labor; and eliminate discrimination in respect of employment and occupation.</p> <p>Environment: Businesses should support a precautionary approach to environmental challenges; undertake initiatives to promote greater environmental responsibility; and encourage the development and diffusion of environmentally friendly technologies.</p>
Lenders' Guidelines		
ENVIRONMENT, HEALTH, AND SAFETY		
World Bank Group	World Bank Safeguard Policy OP 4.01 Environmental Assessment (January 1999, as updated)	Environmental impacts on human populations or environmentally important areas must be identified and the impacts compared with the impacts of feasible project alternatives including the 'without project' situation. The assessment should consider natural and social aspects in an integrated way. OP 4.01 also requires that project-affected groups and local NGOs be consulted about the project's potential environmental and social impacts in order to take into account local views in the project design.
World Bank Group	World Bank Safeguard Policy OP 4.04 Natural Habitats (June 2001)	Projects involving the significant conversion of natural habitats are not supported unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs.
World Bank Group	Environmental Assessment Sourcebook Volumes I and III (1991) & Updates	<p>This provides additional information on the topics presented in the World Bank Safeguard Policies. Key updates include:</p> <p>Update No. 17 (December 1996) Analysis of Alternatives</p> <p>Update No. 18 (July 1997) Health Aspects of Environmental Assessment</p> <p>Update No. 28 (June 2002) Wetlands and Environmental Assessment</p>

Organization	Item	Comment
World Bank Group	Pollution Prevention and Abatement Handbook (1998) General Environmental Guidelines	The World Bank Group may finance industrial projects for which no specific environmental guidelines have been written. In such cases, the Pollution Prevention and Abatement Handbook (PPAH) General Environmental Guidelines chapter can be used.
World Bank Group	Pollution Prevention and Abatement Handbook (1998) Oil and Gas Development (Onshore)	This document establishes general environmental guidelines for those onshore oil and gas explorations projects as well as drilling and production operations.
World Bank Group	Pollution Prevention and Abatement Handbook (1998) Thermal Power For New Plants	This document sets forth procedures for establishing maximum emissions levels for all fossil-fuel based thermal power plants with a capacity of 50 or more megawatts of electricity (MWe) that use coal, fuel oil, or natural gas.
World Bank Group	Pollution Prevention and Abatement Handbook (1998) Petroleum Refining	This document addresses general environmental guidelines for the petroleum refining industry. These guidelines also apply to fractionation facilities.
World Bank Group	Pollution Prevention and Abatement Handbook (1998) Monitoring	Pollutants of concern for the environment must be monitored to obtain reliable information on the quality of ambient air and media.
World Bank Group International Finance Corporation (IFC)	Hazardous Materials Management Guidelines (December 2001)	This document provides guidance for development and implementation of a Hazardous Materials Management Program.

Organization	Item	Comment
World Bank Group (IFC)	Environmental Health & Safety Guidelines (July, 1998) Gas Terminal Systems	The International Finance Corporation (IFC) (member of the World Bank Group) has established environmental, health and safety guidelines for Gas Terminals Systems, including liquid effluents, stack emissions, ambient noise and solid and liquid wastes. These are also applicable to liquefied natural gas facilities in absence of specific sector guidelines.
World Bank Group (IFC)	EH&S Guidelines (June 2003) Environmental and Social Guidelines for Occupational Health and Safety	This guideline applies to places of work associated with IFC financed projects. The place of work may be a building, an installation or an outdoor area. The guidelines also apply to temporary places of work. The guideline covers general aspects of occupational health and safety only.
World Bank Group (IFC)	EH&S Guidelines (December 2000) Offshore Oil and Gas Development	Facilities and activities that are covered under the guidelines include offshore exploratory drilling, development and production activities, pipeline delivery of products, tanker loading and unloading, ancillary and support operations.
World Bank Group (IFC)	EH&S Guidelines (July 1998) Port and Harbor Facilities	IFC has established environmental, health and safety guidelines for the design, construction and use of ports, harbors and associated facilities.
World Bank Group (IFC)	EH&S Guidelines (July 1998) Roads and Highways	These guidelines are for the design and construction of roads and highways. The guidelines incorporate the provisions of the World Bank Policies for cultural properties, indigenous people, involuntary resettlement and water resources management.
SOCIOECONOMIC		
World Bank Group	World Bank Operational Directive OD 4.20 Indigenous Peoples (September 1991) and Draft Operational Policy (OP) 4.10 and Draft Bank Procedure (BP) 4.10 Indigenous Peoples (23	These guidelines provide the reference characteristics to assist with the identification of Indigenous Peoples. These guidelines further define the required actions to be taken to ensure that affected Indigenous Peoples are not disadvantaged in the development process. These guidelines require the adoption of a direct consultation and informed participation approach for identification of adverse effects and development of appropriate measures to minimize or mitigate these and to ensure that Indigenous Peoples benefit from development projects and receive culturally compatible social and economic benefits. This should form an integral part of the social assessment process.

Organization	Item	Comment
	March 2001)	<p>These guidelines require that special efforts and made to avoid displacement of Indigenous Peoples.</p> <p>These guidelines require that a screening exercise is undertaken to determine whether or not there are Indigenous Peoples in the project area.</p>
World Bank Group	World Bank Operational Policy OP 4.12 (December 2001, as Revised April 2004) & Annex A (December 2001) and OP 4.12 Involuntary Resettlement	<p>This policy addresses the requirements for the development of appropriate resettlement measures following involuntary taking of land that results in (i) relocation or loss of shelter (ii) loss of assets or access to assets (ii) loss of income sources or means of livelihood, whether or not the affected persons must move to another location.</p> <p>The guidance requires that the avoidance or minimization of involuntary resettlement is a key criterion in project design.</p> <p>The guidance addresses both physical resettlement and compensation issues and requires the adoption of a direct consultation and informed participation approach for development of the strategy and measures.</p>
World Bank Group	World Bank Operational Policy Note OPN 11.03 Management of Cultural Property in Bank-Financed Projects (September 1986)	<p>The general objective of this policy note is to assist in the preservation of cultural properties and to seek to avoid their elimination.</p> <p>This policy note requires that projects avoid significant damage to nonreplicable cultural property and recommends that projects are sited or designed so as to prevent such damage. In some cases, the project is best relocated in order that sites and structures can be preserved, studied, and restored intact in situ.</p>
World Bank Group	World Bank Safeguard Policy OP 4.11 Cultural Property (August 1999)	<p>This policy requires that projects avoid significant damage to nonreplicable cultural property and recommends that projects are sited or designed so as to prevent such damage. In some cases, the project is best relocated in order that sites and structures can be preserved, studied, and restored intact in situ. The Bank normally declines to finance projects that will significantly damage nonreplicable cultural property and will assist only those projects that are sited or designed so as to prevent such damage.</p>
World Bank Group	World Bank Safeguard Policy OP 4.01 Environmental Assessment (January 1999, as updated)	<p>Environmental impacts on human populations or environmentally important areas must be identified and the impacts compared with the impacts of feasible project alternatives including the 'without project' situation. The assessment should consider natural and social aspects in an integrated way. OP 4.01 also requires that project-affected groups and local NGOs be consulted about the project's potential environmental and social impacts in order to take into account local views in the project design.</p>

Organization	Item	Comment
World Bank Group	World Bank Safeguard Policy OP 4.04 Natural Habitats (June 2001)	Projects involving the significant conversion of natural habitats are not supported by the World Bank unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs.
World Bank Group	Environmental Assessment Sourcebook Volumes I and III (1991) & Updates	<p>This document provides additional information on the topics presented in the World Bank Safeguard Policies. Key updates include:</p> <p>Update No. 17 (December 1996) Analysis of Alternatives</p> <p>Update No. 18 (July 1997) Health Aspects of Environmental Assessment</p> <p>Update No. 28 (June 2002) Wetlands and Environmental Assessment</p>
World Bank Group	Integrating Social Concerns into Private Sector Decision Making: A review of Corporate Practices in the Mining, Oil and Gas Sectors, 1998	This World Bank Discussion Paper (No. 384) addresses the integration of social concerns into project planning and development in the mining and oil and gas sectors. The primary focus of the report is to present recommendations to help corporations manage the social aspects of their activities. It explores linkages between social and environmental assessment of projects, identifies current practices with respect to social assessment and makes specific recommendations on their integration. The paper is aimed at both strategic decision-makers within corporations, government, and NGOs and at those with direct responsibility for managing social issues at project level.
World Bank Group (IFC)	Extractive Industries Review Recommendations, 2003	Recommendations for adopting a strategy for extractive industries development that focuses on reduction of poverty, protection of the environment, improving people's lives and supporting equitable growth. Specific recommendations include: ensuring that extractive industry benefits reach the poor; mitigation of environmental and social risks; promotion of renewable energy and efficiency to combat climate change; strengthening governance and transparency; and protecting the rights of people affected by extractive industry investments.

Organization	Item	Comment
World Bank Group (IFC)	Doing Better Business Through Effective Public Consultation and Disclosure: A Good Practice Manual (1999)	<p>The key objective of this manual is to ensure that meaningful consultation (i.e. adequate and timely information, sufficient opportunity to voice opinions) with relevant stakeholders, including affected groups and other interested parties, is carried out and that their views are taken into account.</p> <p>The manual requires that a Public Consultation and Disclosure Plan (PCDP) is prepared and that public consultation should be part of the scoping phase of the ESHIA process.</p>
World Bank Group (IFC)	Investing in People: Sustaining Communities, Through Improved Business Practice: A Community Development Resource Guide for Companies, 2000	This guide aims to serve as a ‘how-to-guide’ to assist IFC clients and other companies in establishing effective community development programs to channel benefits to communities near, or affected by, their operations
World Bank Group (IFC)	The Equator Principles, 2003	These principles provide a banking industry framework for environmental social risks in project financing. This provides specific guidance for scoping of the ESHIA and sets out specific requirements for the content of an ESHIA
International Best Practice Guidance (Industry and NGOs)		
Energy and Biodiversity Initiative	EBI, 2002	The EBI is a partnership of conservation organizations and oil and gas companies that have developed a series of procedures for ensuring that biodiversity issues are incorporated into all aspects of development projects, including site selection, project design and management systems. ChevronTexaco and BP are members of the EBI.
US and UK	Voluntary Principles on Security and Human Rights	The Voluntary Principles were developed by the US and UK Governments, industry, NGOs and trade unions as a guide for companies to maintain the safety and security of their operations and ensure respect for human rights. The Principles are based on international standards including the Universal Declaration of Human Rights and the ILO Declaration on Fundamental Principles and Rights at Work. They address issues such as the potential for violence, human rights records, security arrangements and conflict analysis. Several UK and US based energy and extractive companies participate in the Principles including ChevronTexaco and BP.

Organization	Item	Comment
Amnesty International	Human Rights Principles for Companies (1998)	<p>Amnesty International has developed a series of best-practice principles, based on international standards, to establish operational procedures for ensuring human rights and social justice. The principles cover:</p> <ul style="list-style-type: none"> • Human Rights • Security • Health and Safety • Slavery • Discrimination • Community Engagement • Fair Working Conditions • Monitoring Human Rights
World Conservation Union (IUCN)	Protected Areas Categories, 1994	<p>This initiative was established to facilitate the collection and dissemination of comparable data and to improve communication between countries on the management of comparable ecosystems. The objective of the protection status is to maintain biodiversity and natural resources and there must be a specific legal or social basis for the protection activities.</p> <p>All protected areas have been classified into 6 categories (remote, national park, natural monument, habitat/species management area, protected landscape/seascape, and managed resource protected area).</p> <p>This initiative does not provide specific management criteria for activities in Protected Areas. However, there are useful guidelines for working with local communities (and protecting their rights and supporting their livelihoods) in protected areas.</p>
International Association of Oil and Gas Producers (OGP)	Oil and Gas Exploration and Production Operations in Mangroves Areas: Guidelines for Environmental Protection, 1993	<p>These guidelines have been jointly prepared by OGP and IUCN. They are intended to provide practical direction to achieve conservation of mangroves and enhance protection of marine ecosystems during oil and gas exploration and production activities. They provide introduction to the functioning and importance of mangrove forests, aspects of environmental management and planning which should be implemented by companies and detailed guidance for carrying out specific types of field operations in mangrove areas.</p>

2.3.3 Angola LNG Project Design Justification Processes

The overall design work for this project is the subject of multiple contracts with separate engineering design contractors. In an effort to ensure consistency, the Angola LNG Project team has provided FEED teams with project definitions, project philosophies and functional specifications. The use of these guidance documents and reference standards will help to ensure overall design consistency and to eliminate or minimize environmental, socioeconomic, health and safety risks. The overall project risk and opportunities identification and evaluation process being incorporated is a hazard and risk based approach for addressing safety and related issues. The requirement for adopting such an approach for the ESHIA process is contained in the World Bank Operational Policy (OP) 4.01 on Environmental Impact Assessment (see Box 2.2).

Quantitative Risk Assessment (QRA) methodologies are typically used to identify where risks need to be reduced to as low as reasonably practicable and to identify potential incidents that may have consequences to people and the environment, and the frequency with which they may occur. The consequences will also be assessed as part of the ESHIA and where these are deemed to be potentially significant (in terms of a combination of magnitude of impact and probability of occurrence) further risk reduction and or contingency measures will be evaluated as necessary.

An initial QRA was performed for the Project by an independent consulting company to thoroughly evaluate safety risks associated with the locations being evaluated during the LNG Plant site selection process. Subsequently, an additional QRA was performed on the selected LNG Plant site alternative by another independent consulting firm to further evaluate safety and ensure that the Project team's recommendation on site selection was valid from this perspective. This latter QRA study identifies and ranks the major contributors to individual and societal risks and provides recommendations for risk reduction measures. This information will be used as essential input data for the engineering design and ESHIA processes. Further QRA studies will be undertaken as required during the engineering design and ESHIA processes.

In addition to utilizing QRAs during design, the ESHIA contractor will interface with the engineering design teams to share information as developed during baseline characterization, to identify potential effects and make recommendations on mitigation options. Such recommendations will be worked with the engineering design teams to ensure that solutions are achieved that address environmental, health, and socioeconomic conditions to the extent practicable.

**Box 2.2. Definitions of Hazard and Risk Assessment from Annex A
(Definitions) to World Bank Operational Policy 4.01 on Environmental Impact
Assessment**

Hazard Assessment: An instrument for identifying, analyzing, and controlling hazards associated with the presence of dangerous materials and conditions at a project site. The Bank requires a hazard assessment for projects involving certain inflammable, explosive, reactive, and toxic materials when they are present at a site in quantities above a specified threshold level. For certain projects, the EA report may consist of the hazard assessment alone; in other cases, the hazard assessment is part of the EA documentation.

Risk Assessment: An instrument for estimating the probability of harm occurring from the presence of dangerous conditions or materials at a project site. Risk represents the likelihood and significance of a potential hazard being realized; therefore a hazard assessment often precedes a risk assessment, or the two are conducted as one exercise. Risk assessment is a flexible method of analysis, a systematic approach to organizing and analyzing scientific information about potentially hazardous activities or about substances that might pose risks under specified conditions. The Bank routinely requires risk assessment for projects involving handling, storage, or disposal of hazardous materials and waste, the construction of dams, or major construction works in locations vulnerable to seismic activity or other potentially damaging natural events. For certain projects, the EA report may consist of the risk assessment alone; in other cases, the risk assessment is part of the EA documentation.

A crucial feature of the engineering design and ESHIA processes will be the collaboration between the Angola LNG Project engineering design teams and the ESHIA consultant. This will allow mitigation measures to be built into the design and will help ensure that management plans are developed to address critical issues. Each FEED team has a dedicated HES representative to facilitate this collaboration.

Community and business leaders participating in site selection and follow-up meetings as part of stakeholder engagement.



3.0 THE ESHIA PROCESS

3.1 Introduction

The ESHIA process is an iterative process forming an integral component of all stages of project design and implementation, from concept selection through operations management and operations abandonment and, where relevant, reinstatement. A flow diagram indicating the overall ESHIA process is shown in Figure 3-1.

The Angola LNG Project intends to conduct the ESHIA in alignment with the World Bank Guidelines and Policies and EBI Tools as well as in compliance with the Angolan legislative requirements relating to the EIA process and control over the construction and operation activities for the Project facilities.

In order to implement the commitment to carry out an ESHIA, Angola LNG has brought together an international and Angolan national team that includes engineers and health, safety, socioeconomic, and environmental specialists.

Regardless of its role in the permitting and approvals process it is also important to note that the ESHIA is a tool that can help project design and decision-making, by identifying impacts early so that mitigation options can be fully evaluated and incorporated into design.

There will be a collaborative effort between the Angola LNG Project engineering design teams and the ESHIA consultant to allow mitigation measures to be built into the design and help ensure the development of appropriate environmental, socioeconomic and health management plans.

An integrated approach will be taken by the ESHIA consultant to ensure that the assessment of effects and the development of related mitigation measures for environmental, socioeconomic, and health aspects is coordinated.

The ESHIA process will incorporate a stakeholder consultation and disclosure program to facilitate the incorporation of stakeholder views in the development and execution of the ESHIA studies and to communicate at key points with a wide range of stakeholders.

The Angola LNG Project team is also committed to working with and providing information regarding environmental sensitivities and social issues for the “Conceptual Plan for Coordinated Industrial Development for the Soyo Municipality” study being conducted by Sonangol. In addition to representing a key supporting program for the Angola LNG Project environmental and socioeconomic impact assessment, it is anticipated that the plan can be used to

assist with the establishment of a planning basis for consideration by key stakeholders involved in promoting other industrial development, within the Soyo Municipality and the greater Zaire province.

3.2 Requirement for EIA under Angolan Legislation

3.2.1 Introduction

Under Angola legislation the Angola LNG Project requires an EIA to be undertaken and submitted as part of the approvals process. Throughout this document, reference will be made to the term ESHIA – Environmental, Socioeconomic, and Health Impact Assessment. This term has been chosen to reflect the fact that although Angolan legislation requires an EIA (Environmental Impact Assessment) to be undertaken (see Section 3.2.2), socioeconomic, socio-cultural, and community health and safety are also addressed as important elements of the Project. In a legal and procedural context, the Angola LNG ESHIA will meet all the requirements of Angolan legislation.

The Angola Ministry of Petroleum Regulation on EIA states that the EIA procedure includes the Environmental Impact Study, the Environmental Impact Assessment Final Report and Public Consultation.

Section 3.2.4 describes the project approval process and how the EIA and consultation fit into it.

3.2.2 Legislation on Environmental Impact Assessment

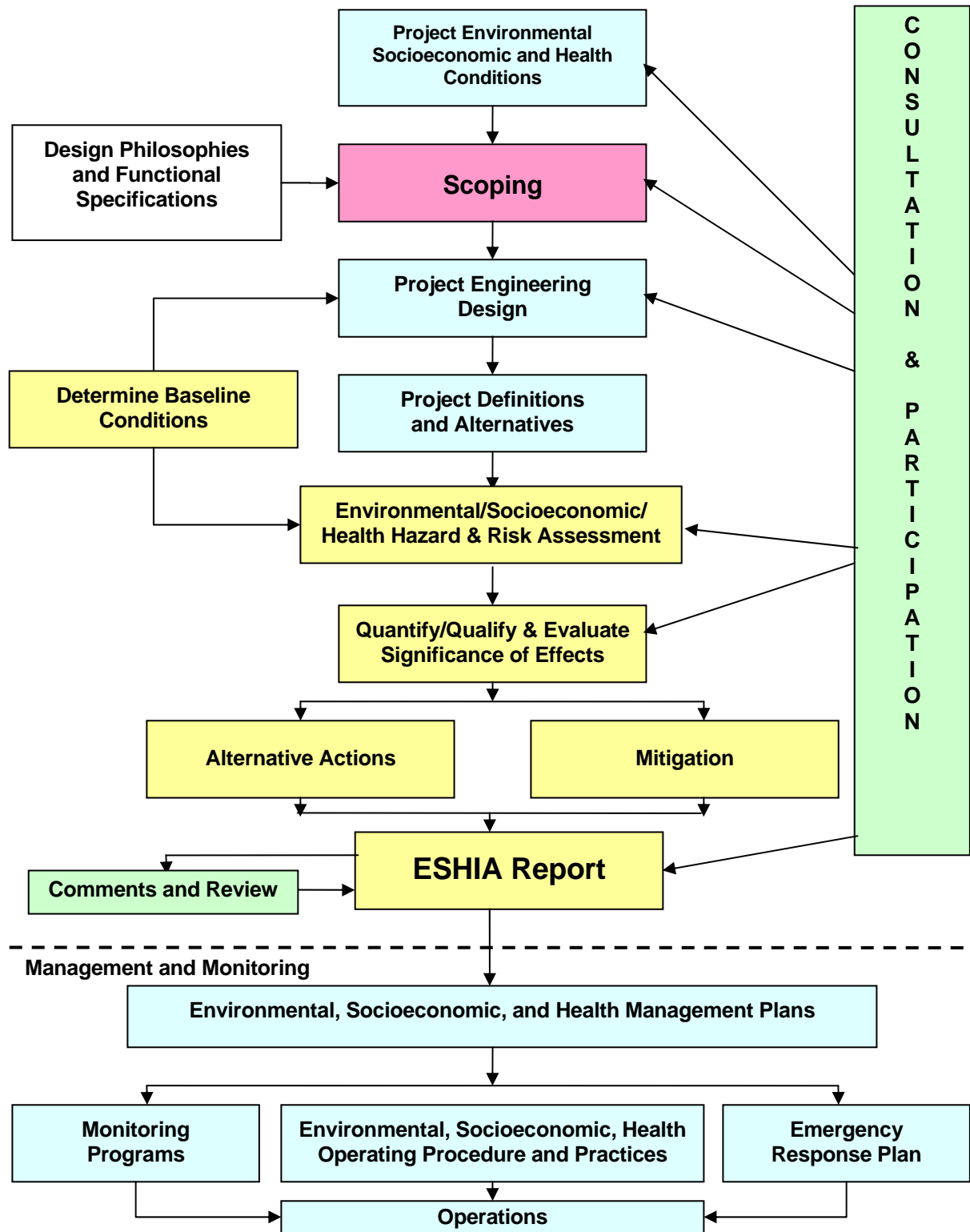
The requirement for an EIA is set out under the General Environment Law 1998 (5/98); decree 39/00 on Environmental Protection for the Petroleum Industry; and the Republic of Angola Ministry of Petroleum Regulation on Environmental Impact Assessment Decree 51/04 (2004). In addition, the need for public consultation is also addressed under the General Environment Law (5/98) and the Decree 51/04.

3.2.3 EIA Contents

Under the terms of the Angolan Regulations, the Environmental Impact Study shall include the following:

- a. A description of the project and of the technological alternatives;
- b. The objectives and justifications of the project and how they relate to the plans and programs that already exist or are under way in the affected area;

Figure 3-1: The ESHIA Process



- c. Environmental diagnosis of the area impacted by the project, detailed description and analysis of the environmental resources and its interactions, as they exist, in order to ascertain the environmental status of the area before implementing the project, taking into account:
 - i. the physical environment – subsoil, water, air, climate, focusing on mineral resources, topography, types of soil, water bodies, the hydrological regime, sea and atmospheric currents;
 - ii. the biological environment and natural ecosystems – fauna and flora, focusing on the species that indicate the quality of the environment, species with scientific and economic value, rare and endangered species and permanently protected areas;
 - iii. the socioeconomic environment – use and occupation of land, use of water and social economy, dependency relationships among local communities, the environmental resources and the potential future use of these resources;
 - iv. The characterization of the future environmental quality of the impacted area, comparing the different adopted situations and their alternatives, as well as the possibility of not executing the project;
 - v. review of possible positive and negative environmental impacts of the project, identification and forecast of its magnitude and duration, direct and indirect impacts, immediate and short and long term impacts, temporary and permanent impacts, as well as the chances of reversing them, its cumulative properties and synergies and socioeconomic benefits;
 - vi. legal, financial, economic and practical measures that need to be taken in order to reduce as much as possible the negative environmental impact; and
 - vii. Environmental impact surveying and monitoring programs.

In addition the results of the study will be submitted together with a non-technical Summary of the main issues discussed and the proposed conclusions, in a form and language readily understood by the general public.

The report will also be supported by photographs, charts and maps, and clear reference (including excerpts) to laws, decrees and international or regional conventions that support the study.

3.2.4 The Approval Process

The EIA approval process in Angola for hydrocarbon projects is led by the Ministry of Petroleum (MinPet) with inputs from the Ministry of Urbanism and Environment (MinUA). It is the latter that eventually grants the Environmental License. Key points in relation to the EIA permitting procedure are highlighted in Figure 3-2.

The project team intends to work cooperatively with the appropriate Angolan government ministries to ensure that the ESHIA process can be completed in a timely manner.

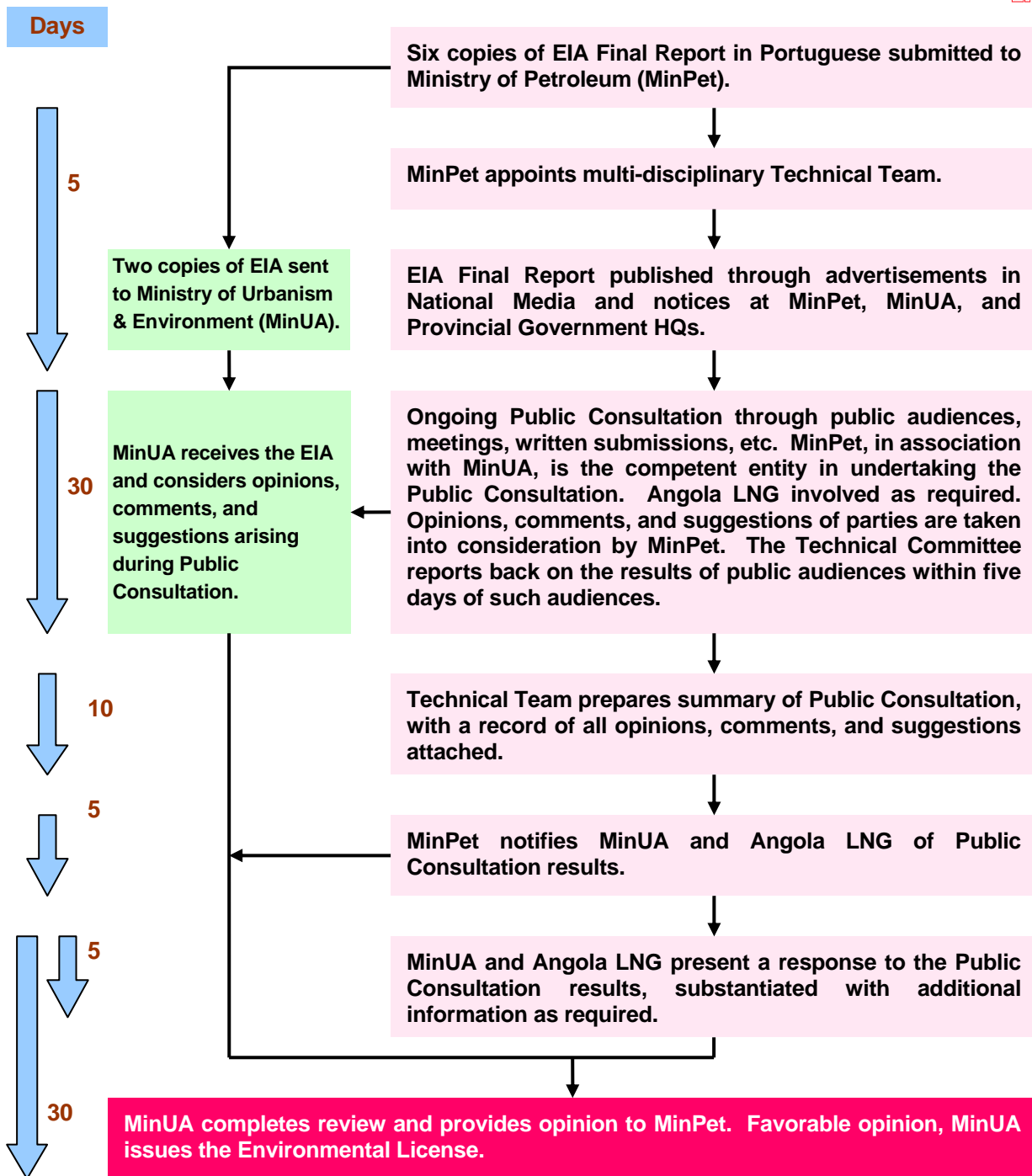
3.3 The World Bank Group Requirements for EIA

While this is not a World Bank Group project, the Angola LNG Project has voluntarily undertaken the intent to be consistent with World Bank Group Guidelines. As such, the ESHIA processes adopted will be similar to that for a Category A defined project within the World Group Guidelines. Project-affected groups and local NGOs must be consulted about the potential effects. The IFC's manual 'Doing Better Business Through Effective Public Consultation and Disclosure: A Good Practice Manual' provides action oriented guidelines aimed at ensuring that consultation is both effective and meaningful. The guidelines emphasize the need for the project sponsor to ensure that the process of public consultation is accessible to all potentially affected parties, from national to local level. Emphasis is placed on the engagement of local stakeholders, namely people who are likely to experience the day-to-day impacts of a proposed project.

The World Bank Group also has specific requirements for disclosure and consultation for documentation resulting from the EIA process. The IFC recommends the preparation and publication of a Public Consultation and Disclosure Plan (PCDP) for consultation and disclosure during each phase of the ESHIA process. The Angola LNG Project has therefore voluntarily undertaken to prepare a PCDP to direct the consultation and disclosure program for their ESHIA process.

The IFC also recommends the preparation of an Environmental Action Plan (EAP) and promotes a number of other environmentally and socioeconomically related factors including biological diversity, wetlands and wild birds, cultural property; waste management, natural resource use evaluation, hazardous and toxic materials, major and natural hazards; indigenous people; involuntary resettlement; and induced development and other socio-cultural aspects.

Figure 3-2: Angolan EIA Approval Process



The number of days indicated above are the timeframes within which actions are to take place.

Guidance contained in the World Bank Pollution Prevention and Abatement Handbook sets out limits for effluent discharges to water, pollutant emissions to atmosphere and noise (see Table 2.2).

Further World Bank Group requirements pertaining to Indigenous Peoples' rights and involuntary physical and economic resettlement are outlined in specific Safeguard Policy Documents (see Table 2.2). The Safeguard Policy relating to Indigenous Peoples requires that a screening exercise is undertaken to determine whether or not Indigenous Peoples will be affected by the development. If it is determined that this is the case then specific attention will need to be paid in the ESHIA on the effects on Indigenous Peoples, the determination of appropriate mitigation measures and the identification of culturally compatible social and economic benefits. Further, a management plan will need to be developed in consultation with the affected people. The Safeguard Policy relating to Involuntary Resettlement provides guidance for the development of appropriate levels of compensation and assistance to people who would require economic or physical resettlement as a consequence of the development. It requires the preparation of a resettlement plan (the scope of which is dependent on the level of involuntary resettlement identified) in consultation with the affected persons.

3.4 ESHIA Scoping

Scoping is an important part of the ESHIA process (see Figure 3-1). The key objective of which is to develop the Terms of Reference for the ESHIA through the provisional identification of what are believed to be the key issues through consultation and disclosure with stakeholders. Subsequent phases of the ESHIA process can then focus on these key issues in terms of collecting information on existing conditions, engaging stakeholders, understanding the impacts and developing the measures to avoid or control and monitor them.

This document and a separate non-Technical summary of this report have been prepared to support the scoping consultation and disclosure process. These documents present the current views of the Angola LNG Project, based on past experience and professional judgment and the findings of the preliminary program of consultation and disclosure undertaken in support of the site selection process. The purpose of circulating these documents to key stakeholders and undertaking associated scoping consultations is to obtain their inputs so that the Terms of Reference for the full ESHIA addresses the concerns and views of those consulted.

3.5 The Overall Scope of the ESHIA Process

3.5.1 Introduction

This section summarizes the general considerations for progressing the ESHIA process. The management of specific issues is discussed in Section 6.0, while the

integration of the ESHIA process with the engineering design process is discussed in Section 2.3.

The full ESHIA process comprises the following key elements:

- Scoping leading to the production of the Scoping Report and Terms of Reference (TOR).
- Environmental, Socioeconomic, and Health Baseline Characterization.
- Effects Identification and Assessment
- Stakeholder Consultation and Disclosure involving production of a Public Consultation and Disclosure Plan (PCDP).
- Production of the ESHIA Report.
- Development of ESHIA Management Plan in accordance with World Bank Guidelines and Policies.

3.5.2 Baseline Data Collection

A significant amount of data has already been collected as part of the site selection and scoping activities. Now that a specific site for the Angola LNG facilities has been selected, future data gathering activities can be targeted and can focus on key issues for the Angola LNG (see Section 5.0).

3.5.3 Impact Identification and Assessment

The full ESHIA will adopt a quantitative approach to impact prediction to the extent possible. This will include the use of mathematical and computer modeling. Where qualitative approaches have been adopted, the ESHIA will clearly set out how and what professional judgment has been applied and will reference sources from which past experience has been drawn. As part of the ESHIA potential impacts will be identified and their individual, cumulative and inter-practice impacts will be assessed in a fully integrated manner (see Section 6.0).

3.5.4 Consultation & Disclosure

Stakeholder responses to this scoping report will be the focus of the next stage of public consultation and will be used to shape the ESHIA process moving forward. Public consultation will continue throughout the ESHIA process, particularly with regard to addressing the key issues and ensuring the input of local knowledge. The Public Consultation and Disclosure Plan (PCDP) will guide these consultation activities and will be appended to the draft ESHIA report. The latter will be

disclosed to all key Project stakeholders and feedback will be solicited as required by both national Angolan legislation and international guidelines.

The PCDP will provide a program for consultation and disclosure that will ensure accessible and timely opportunities for stakeholders to become involved in the Angola LNG Project decision-making process. The consultation process will continue throughout the ESHIA process and extend into the project construction, commissioning and operations phases of the Angola LNG Project.

3.5.5 Production of the ESHIA Report

The proposed content for the ESHIA is presented in Box 3.3. This will need to be agreed with the regulators, and has been presented here for review and comment by stakeholders other than partners.

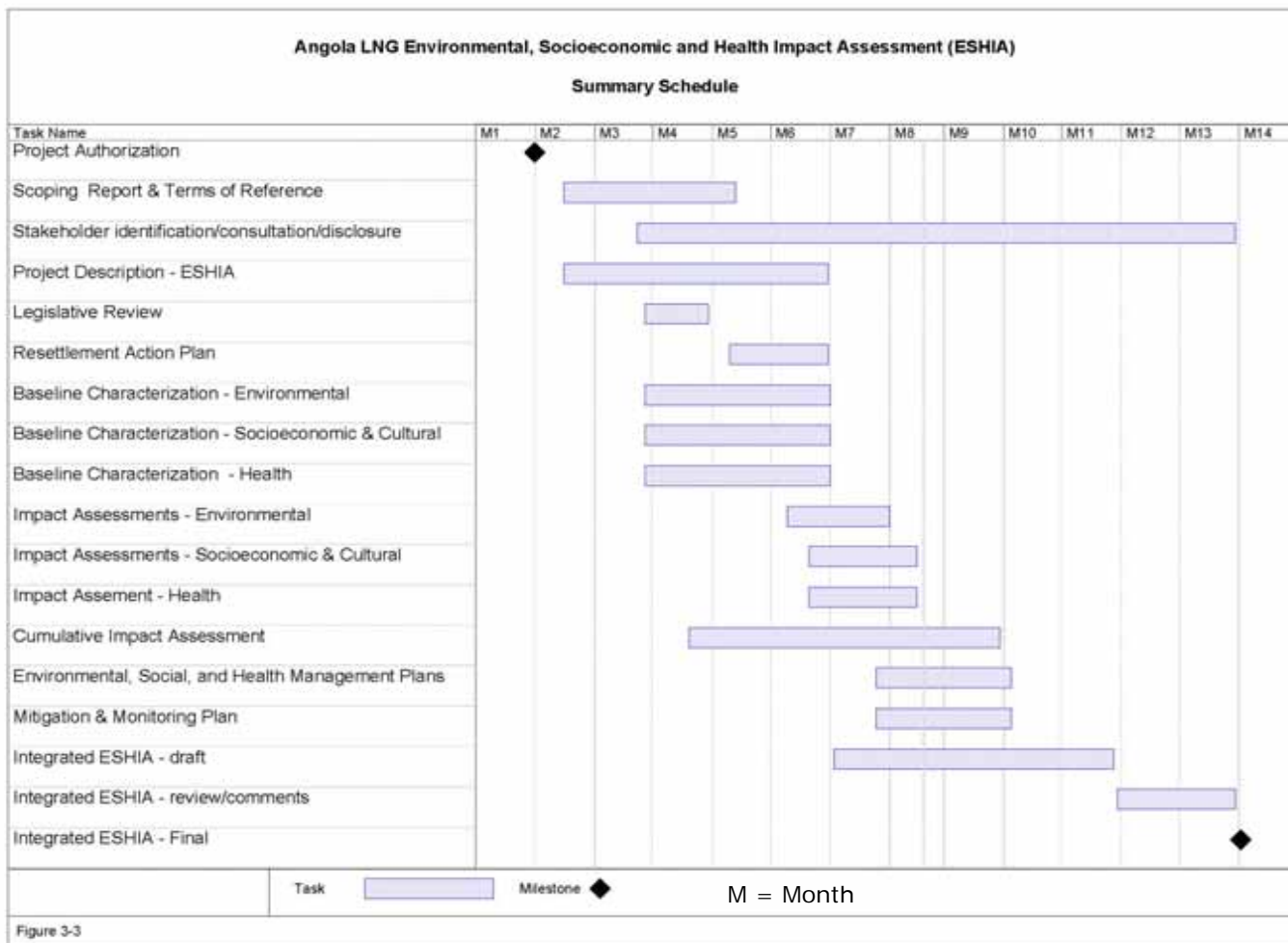
Box 3.3 Proposed Contents for the ESHIA
Executive Summary
Glossary
Introduction
Policy, Legal and Administrative Framework
ESHIA Methodology
Project Description
Alternative Options Assessed
Emissions, Discharges and Waste Inventory
Environmental Baseline
Socioeconomic and Health Baseline
Health Assessment
Socioeconomic Assessment
Consultation and Disclosure
Environmental Aspects and Impacts
Socioeconomic Aspects and Impacts
Health Mitigation, Monitoring, and Management
Cumulative Impacts
Transboundary Impacts
Environmental Mitigation, Monitoring and Management
Socioeconomic Mitigation, Monitoring and Management
Conclusions
Stakeholder Comments and Angola LNG Responses
Commitments Register
References
Appendices

3.6 ESHIA Schedule

Prior to construction, the Project will complete the ESHIA process. The Angola LNG Project requires that the preparatory works (see Section 2.2.4) are undertaken significantly earlier than the main construction program for the onshore facilities and the marine terminal. As a consequence there is a requirement from the government to produce a separate EIA report for the dredging, land reclamation and unexploded ordnance clearance works that comprise the preparatory works. The schedule for preparation and submission of this document is separate from the schedule for the ESHIA process for the main construction program for the onshore facilities, marine terminal, and the offshore pipelines. The EIA for the Dredging and Land Reclamation activities will be completed prior to the submittal of the ESHIA report.

The outline schedule for the ESHIA process is provided in Figure 3-3.

Figure 3-3: ESHIA Schedule



Scientists will be examining conditions in the field to accurately assess possible impacts and develop appropriate mitigation plans.



4.0 PRELIMINARY EVALUATION PROGRAM

4.1 Introduction

The preliminary evaluation program, as outlined in this section, commenced in 1997, prior to the establishment of Angola LNG and subsequent to the decision of the Angolan Government to enact a policy that would lead to the restriction of flaring of gas associated with oil and gas production operations offshore Angola. In addition, oil and gas operators were required to develop plans for monetization of this gas that would in part lead to the promotion of economic growth in Angola through utilization of the gas for commercial purposes (see Section 1.2).

Angola LNG was established to take forward the proposal originally submitted by Texaco in 1997 to Sonangol for the management of the gas associated with oil and gas production activities offshore Angola. The proposal was subsequently selected by Sonangol as the preferred solution for the management of gas. The proposal from Texaco included the evaluation of competing technologies and the 'No Project' scenarios (see Section 4.2).

Since its establishment in 1998 the Angola LNG Project has undertaken conceptual engineering design and implemented a rigorous preliminary evaluation program in order to identify the Preferred Project Alternative and site location. The key focus of this preliminary evaluation program has been a phased site selection exercise involving extensive consultations with stakeholders (see Section 4.3).

This preliminary evaluation program led to:

- Identification of the most suitable region of Angola for the location of the LNG project facilities.
- Identification of the most suitable site options within that region for further consideration.
- Identification of the selected site, namely the Best Shipping Alternative, located in the Soyo municipality of the Zaire Province in Angola.

The Angola LNG Project team has undertaken a rigorous site selection exercise that started in 1997, that has: 1) served to identify the most suitable region of Angola for the location of the LNG Project facilities; and 2) identified within that area the most suitable site options for further consideration.

A full account of the site selection process from an environmental and socioeconomic perspective is documented in:

- *Environmental and Socio-Economic Considerations for the Siting of the Angola LNG: Final Report. ERM, May 2004.*

4.2 The No Project and Competing Technologies Evaluation

The scope of this study was two-fold. First, to consider the implications of not undertaking any new development to effect commercialization of the natural gas generated by the offshore oil and gas production activities (the ‘No Project’ scenarios). Second, to identify and evaluate alternative solutions for the management of gas produced from oil and gas production activities offshore Angola that would lead to commercialization of the gas.

The ‘No Project’ scenarios and the various competing technologies for commercialization of the natural gas that were considered are listed below:

‘No Project’ Scenarios:

- No action (continue flaring out of compliance with the Angolan Regulations).
- Re-injection of gas into the producing reservoir (elimination of flaring only).
- Re-injection of gas into depleted reservoir (elimination of flaring only)
- Re-injection of gas into saltwater aquifer (elimination of flaring only).
- Shut-in host oil production (elimination of flaring and loss of oil and gas revenues).

Competing Technologies:

- Gas to Liquids (GTL) Production and Export (Commercialization of the gas).
- Liquefied Natural Gas (LNG) and Export (Commercialization of the gas).
- Methanol Production and Export (Commercialization of the gas).
- Ammonia Production and Export (Commercialization of the gas).
- Hydrate Production and Export (Commercialization of the gas).
- Gas export pipeline (Commercialization of the gas).

The ‘No Project’ options were concluded to be unacceptable or technically or economically unfeasible. Therefore, oil and gas operators would need to develop plans for commercialization of the natural gas.

The Project’s decision to propose LNG as the technical solution was based on an assessment of competing technologies. Worldwide there are numerous natural gas reserves that are considered “stranded” since there are little or no local markets to absorb the gas. This is true of the natural gas found offshore Angola. In these cases, the natural gas must be transported a considerable distance to suitable

markets. It was concluded that the only economically and technically viable method of achieving this for Angola was through export of LNG.

The conclusion of the 'No Project' study was therefore, that there is not an option to 'do nothing' if oil production in Angola is to continue and achieve compliance with national legislation. The only viable option therefore, being the Angola LNG Project. The 'No Project' Scenarios will be developed in greater detail in the ESHIA.

4.3 Decision to Develop a Coastal LNG Project at Soyo

Subsequent to identifying the LNG process as the preferred solution, the Angola LNG Project embarked on a series of studies leading to the assessment of the Final Four Soyo Site Options that form the focus of the discussion in Section 4.4. The sequence of this series of site selection studies is presented below:

- Early Conceptual Studies of Offshore Options (3rd Quarter 1998).
- Early Conceptual Studies of Onshore Options (4th Quarter 1998).
- Final Conceptual Studies (4th Quarter 2002).
- Original Soyo Alternatives (2nd Quarter 2003).
- Assessment of original Soyo Shortlist (2nd Quarter 2003).
- Addition of final Soyo options (4th Quarter 2003).
- Assessment of Final Four Soyo Options (December 2003 to May 2004).

These studies involved the following:

- The assessment of offshore versus onshore options.
- The assessment of various potential development sites along the Angola coast.
- The assessment of various potential development sites in Soyo.
- The detailed assessment of the short-listed four Soyo options (see Section 4.4).

In assessing alternatives a number of factors were considered, including environmental, socioeconomic, health and safety, operability, security, cost, schedule, potential to promote economic growth and stakeholder views.

The choice of sites for the Angola LNG facilities changed several times during the course of the evaluation program. A number of possible locations along the Angolan coastline were examined by the project during this time.

During the second stage of the evaluation (April 2002 through to October 2002) both offshore and onshore sites were still under consideration. The key onshore

focus areas were Luanda Refinery, Near Luanda, Onshore Soyo Area and Onshore Ambriz.

Soyo was not identified as a potential focus region until the later stages of the evaluation primarily because of civil war activities in this area and the associated security issues. When the war ended in 2002, the Soyo area became a viable option.

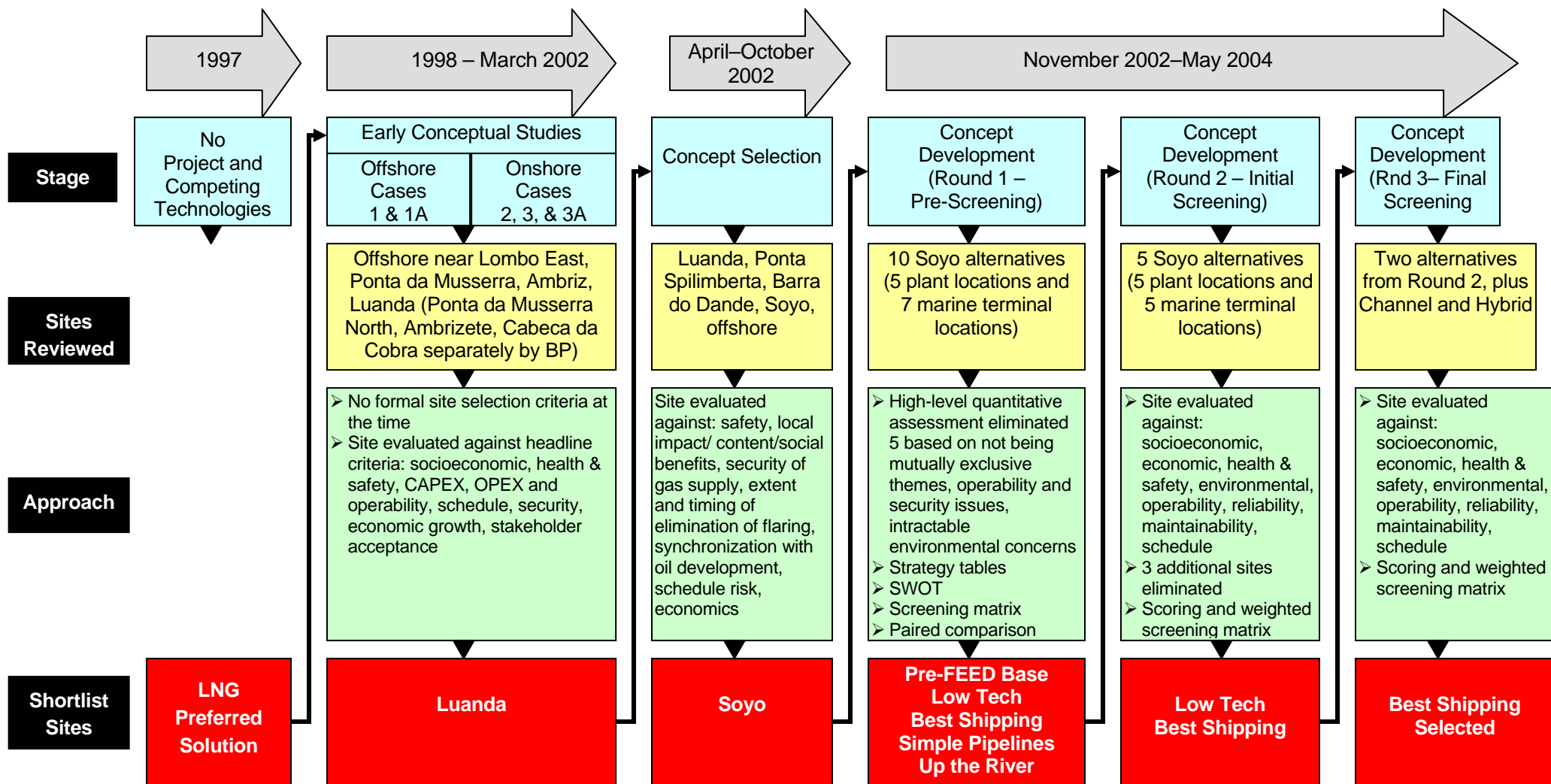
During the third stage of the evaluation (November 2002 through to May 2004) an onshore solution in the Soyo area was established as the focus for the evaluation program. The Soyo area, although containing some environmental and socioeconomic sensitivities was thought to be the most viable option due to the capacity to ensure security and, more importantly to promote secondary economic growth. The Angola LNG Project team deemed the potential positives of the Soyo area outweighed any potentially negative environmental and socioeconomic sensitivities associated with it.

It was therefore decided that the Soyo area was the only location that should be progressed as part of site selection. As a consequence, the area underwent a more detailed level of screening for feasibility of Project location and design. During this third stage of the evaluation program, the viable alternatives for the siting of the onshore processing and storage facilities, marine terminal and import gas line were identified and screened. The viable alternatives were narrowed down to four final sites in the Soyo area which were then subject to the site selection process described in Section 4.4 and resulted in the subsequent selection of ‘The Best Shipping Alternative’ as the selected site.

It is important to note that a fundamental factor that has influenced the selection of Soyo as the most viable option for the Angola LNG Project has been the clear guidance by the Angolan government that the site accommodate secondary development and be capable of promoting economic growth. This factor focused the Project to the Luanda and Soyo options. With the Luanda option being fundamentally flawed from a socioeconomic perspective due to the need for significant physical resettlement, the Soyo area became the most viable option that conformed with these expectations.

A summary of the evaluation program is provided in Figure 4.1.

Figure 4-1: Site Selection Activities



4.4 The Final Four Soyo Options

4.4.1 The Evaluation Approach

Project acceptability boundaries and site selection criteria were developed by the Angola LNG Project team to enable a comparative assessment of the four site options available.

The Project acceptability boundaries were that the site must align with World Bank requirements (with respect to socioeconomic and environmental impacts and public participation in the decision-making process) and that the public safety risk must be acceptable.

In order to address the latter project acceptability boundary, Quantitative Risk Assessments (QRAs) were commissioned by the project team (see Sections 2.2.3 and Section 4.4.4).

In order to address the former acceptability boundary a review was undertaken of the relevant World Bank Guidelines and Policies and a baseline data collection, public consultation and disclosure and impact assessment program was integrated into the evaluation.

The World Bank Guidelines and Policies against which the site selection options were assessed are included in Table 2.2. In particular, the World Bank Policies address the following issues: environmental assessment, natural habitats, cultural property, involuntary resettlement, indigenous peoples, wetlands, and other issues. The guidelines provide guidance on how to reduce pollution, and in many cases they include numerical targets and maximum emission and discharge limits to be achieved.

The site selection criteria developed were:

- **Socioeconomic Impacts**
 - Resettlement
 - Cultural sites
 - Land Acquisition, rights-of-way
 - Intervention of NGOs
 - Infrastructure
 - Decommissioning strategy
- **Environmental Impacts**
 - Impact of construction, especially on wetlands (mangroves)
 - Impact of operations, especially on wetlands (mangroves)

- Water Quality
- Coastal morphology
- Biodiversity
- Erosion and sedimentation
- Threatened species
- Sediment quality
- **Health and Safety Impacts**
 - Impact of construction on local population
 - Impact of operations on local population
 - Impact of construction on facility and workforce
 - Impact of operations on facility and workforce
- **Economic Growth**
 - Potential to promote secondary industry
 - LNG plant expandability
 - Consultations and stakeholder acceptance
 - Capital expenditure (CAPEX) impacts
 - Operability and operational expenditure (OPEX) impacts
 - Schedule impacts
 - Security

A key objective of the evaluation was to ensure that the work was conducted in accordance with international expectations of such an exercise. In addition to the World Bank Guidelines and Policies, the Angola LNG Project team also made reference to the Energy and Biodiversity Initiative (EBI) Tools for site selection in order to design and implement their evaluation program in such a way as to satisfy this key objective. The EBI, a partnership of four energy companies and five conservation organizations, has developed the EBI Tools to assure integration of biodiversity conservation into oil and gas development. The EBI website address is www.theebi.org.

The work supporting the third stage evaluation took place over approximately six months. During that time, data were collected on the project area through literature studies, provision of information from other studies commissioned by Angola LNG, visits to the sites to collect environmental and socioeconomic data, and review of satellite imagery. Consultations and workshops were undertaken with local community representatives, government regulators, and non-governmental organizations (NGOs).

The evaluation was supported by analysis of the four alternatives using Geographical Information System (GIS) and a hydrodynamic model. This degree of quantification allowed the comparative exercise of site selection to be considerably enhanced.

The key environmental and socioeconomic issues focused on as part of the site selection work were as follows:

Environmental:

- Geomorphology and coastal processes.
- Biodiversity.
- Water quality.

Socioeconomic:

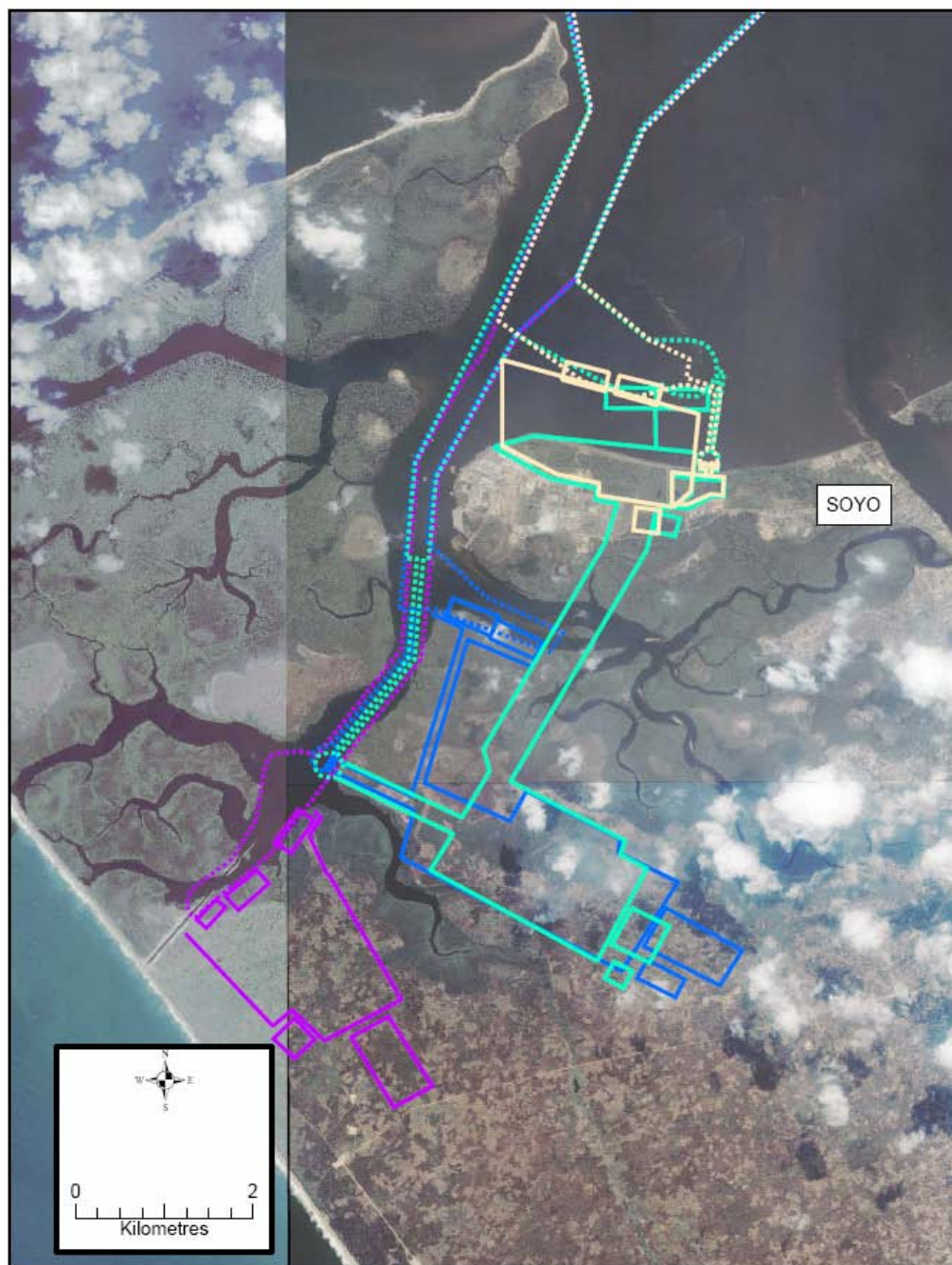
- Land-based livelihoods and recreation.
- Settlements and buildings.
- Fisheries-base livelihoods and waterborne transport.
- Cultural sites.
- Planning and development.
- Community Health and Safety.



4.4.2 The Four Soyo Locations and Environmental and Socioeconomic Setting

The environmental and socioeconomic setting for the general area is described in Section 5.0.

The locations of the four Soyo site alternatives that were considered are shown in Figure 4-2 and their key characteristics are summarized in Box 4.1:

Figure 4-2: Site Alternatives



	 8 Cavendish Square London, W1G 0ER Tel: 02074657200 Fax: 02074657272	Project:	0006623	Size:	A4
		Date:	24-05-04	Approved:	
		Drawn:	DAM	Scale:	As Scale Bar
		Drawing:		Rev:	1
Chevron Texaco		Four Site Alternatives in the Soyo Area			

Box 4.1: Key Characteristics of the Four Site Alternatives

Low Tech: The Low Tech Alternative is located on land that is mainly used for agricultural purposes. The northern boundary of the site is located on dwarf and intermediate mangrove habitat and beach. Eight small settlements are located on the site, one of which is believed to be used as primary housing by its three residents. The land is used for subsistence agriculture, there is a cultural site within the Footprint Area and there is a popular beach close by. This alternative would require extensive deep dredging of the Pululu channel.

Channel: The Channel Alternative is bounded on the north by the Pululu channel and a smaller inlet to the west. Both of these water bodies are bordered by dwarf mangroves and are used for fisheries. On the corner of the waterways is a small village of less than four buildings. Inland, most of the land is not used for agriculture although fruit is gathered from some of the trees. A number of cultural sites are situated close to the perimeter and along the existing access road. This alternative would require considerable deep dredging of the Pululu channel.

Best Shipping: The Best Shipping Alternative consists of land within the existing Kwanda Base and reclaimed land. This land has some commercial warehouses, but has no other productive activities. The site is located close to the town of Soyo and to the commercial port and would require widening of the existing dredged channel, together with dredging in front of the berth area.

Hybrid: The Hybrid Alternative is sited on a land area within that allocated for the Channel option, some of which is used for cultivation. The marine facilities are sited as per the Best Shipping Alternative. A pipeline corridor is required between the two facilities.

4.4.3 Environmental and Socioeconomic Data Collection and Public Consultation and Disclosure

The Angola LNG Project team has undertaken a number of visits for the purpose of stakeholder consultation and high level environmental and socioeconomic data gathering and project orientation. The focus of these consultations was consulting local and Angolan stakeholders with the most relevant day-to-day experience with issues of immediate concern. Some of the key visits are described below:

- An initial site visit in May 2003 served to orient the Angola LNG Project team to understand high level environmental issues in the area and determine the appropriate category under the World Bank criteria.
- In September 2003, a visit was conducted to clarify and understand issues identified in May 2003 by the Angola LNG Project team. This included visits to the potential Project sites and to community projects.
- In December 2003, a two-week field trip was undertaken with the purpose to consult with national and local Angolan Government officials, academics and local NGOs. In addition a high-level study of physical aspects of the mangrove system was undertaken. A program of socioeconomic fieldwork was also initiated.

- The focus of a visit in April 2004 was on socioeconomic data gathering and consultations with the communities, local government and other Soyo-based stakeholders about specific siting alternatives.
- In August 2004, a visit was conducted with the purpose to inform the local traditional leaders and local government representatives of the Angola Project decision to select the Best Shipping Alternative as the Selected Project Site.

The key objectives of the first round of consultations, in December 2003, were:

- Introduce the Angola LNG Project and the site selection process.
- Demonstrate that Angola LNG was committed to engagement with the public.
- Lay the foundation for future stakeholder participation.
- Support the early identification of key issues and concerns, expectation and opportunities.

The key target stakeholder groups for this first round of consultations were:

- Key national decision makers.
- Key regional and local decision makers.
- Respected knowledge holders (i.e., academic institutes and NGOs).

The key objective of the second round of consultations in April 2004 was to invite local stakeholders to voice preferences and concerns on alternative siting locations and to disclose further information on the potential environmental, socioeconomic, and health impacts.

The key target stakeholder groups for the second round of consultations were:

- Communities potentially directly affected by any of the four siting options under consideration.
- Key regional and local decision makers and advisors.
- Respected knowledge holders, influencers and local businesses (i.e. Soyo-based NGOs, businesses and church leaders).

The project's focus at this time was consulting local and national stakeholders with the most relevant day-to-day experience for site selection issues.

During the first round of consultations 20 meetings were held, and a further 16 meetings were held during the second round of consultations. The list of consultees is provided in Appendix B.

4.4.4 Stakeholder Perceptions

The key messages from the first and second rounds of consultations are summarized in Box 4.2.

Box 4.2. Key Messages from the Consultations		
Issue	First Round	Second Round
Project Overall	<ul style="list-style-type: none"> Strong support for the Project. High expectations – particularly in terms of perceived local employment and socioeconomic investment benefits. Concern over the lack of local benefits and negative impacts from previous oil investments. 	<ul style="list-style-type: none"> Strong support for the Project. High expectations – particularly in terms of perceived local employment, socioeconomic investment, and local gas supply benefits. Concern over the lack of local benefits and negative impacts from previous oil investments, particularly related to perceived negative impacts of flaring processes on agricultural crops.
Site Selection	<ul style="list-style-type: none"> Preference for sites away from Kwanda Base from government stakeholders. Low Tech option particularly preferred. Trust in the Project to select the most appropriate location. 	<ul style="list-style-type: none"> Community preference for the Project to be situated in their neighborhood, due to perceived benefits. A strong desire by most communities and Soyo civil society for the Project to lead to secondary development opportunities away from Kwanda Base. Government stakeholders expressed predominant preference for Best Shipping site, with condition that appropriate HES safeguards are in place. Development Workshop (local NGO) viewed Best Shipping as the obvious siting option and warned against other siting options. General trust for the Project to make the appropriate final site selection decision.
ESHIA Process	<ul style="list-style-type: none"> High approval of the ESHIA process. Strong recommendations to maximize local consultation. 	<ul style="list-style-type: none"> High approval and expressions of gratitude for the opportunities to contribute to the site selection process. Impatience for the final decision on site location. Recommendation that further consultation on site selection would not be worthwhile.
Potential Impacts	<ul style="list-style-type: none"> Differing views on difficulty of resettlement should this be required by the Project. Recognition that the Project will be a catalyst for other industry and for in-migration into the area. Recommendations regarding maximizing local benefits. 	<ul style="list-style-type: none"> Welcome the potential for other industry, in-migration and generic local development. Local employment and local gas provision were seen as particularly important benefits. Recognition by Development Workshop (local NGO) that such development does not need to be located next to the LNG facility but in the general Soyo Municipality, or even Zaire Province, area. Welcome the end of flaring, which is seen as a particular threat to agricultural crops. Differing view on whether or not particular agricultural and cultural areas could be used by the Project for the Low Tech Alternative. Concern over community safety issues and impacts due to extracting and moving landfill materials by government stakeholders.

Stakeholder perceptions of the advantages and disadvantages of the different sites were mixed, but can be summarized as follows:

- Government stakeholders were generally better disposed to the Low Tech and Channel options as these were deemed to offer the best opportunities for secondary development.
- Local community stakeholders generally expressed a preference for a siting alternative close to their community on the basis that this provided the greatest opportunity to them to benefit. There was a general perception that options other than Best Shipping would provide more development stimulus and local benefits probably because the existing operations at the Kwanda Base were perceived to have provided limited opportunities for the local community to date.
- Soyo administrators expressed concern over the Low Tech alternative due to the potential livelihood impacts, but found Channel broadly acceptable on the basis that potential cultural impacts could be minimized.
- International (and some national) stakeholders generally favored Best Shipping on the basis it has least environmental and socioeconomic impacts.

There was a general view that Soyo is an appropriate general location for the development, with most stakeholders positively welcoming the Angola LNG Project.

Overall the positive view towards the project is strongly linked to expectations that the Angola LNG Project will provide employment opportunities and will be the catalyst for stimulating secondary industry and hence economic growth locally. In addition local communities stressed the need for local access to energy and voiced the expectation that elimination of gas flaring would lead to the cessation of negative impacts on crop production in the local area that are perceived to be linked to current flaring activities. Local NGOs highlighted the potential for other benefits that the Angola LNG Project could stimulate through socioeconomic investment.

4.4.5 Safety

Safety to neighbors was a key issue in site selection evaluation. Angola LNG commissioned an independent initial QRA of the four alternatives to assess each alternative against individual and societal risk tolerability criteria.

Due to the early design stage and the preliminary nature of the assessment a conservative approach was adopted. For example, allowances were not made for

specific risk mitigation techniques, such as automatic shutdowns, fire and gas detection.

The study concluded that with certain additional risk reduction measures (e.g. the location of certain plant elements, numbers of product tanks) all four of the alternatives could be designed to operate within acceptable levels of risk.

Facility safety was not therefore a critical factor in distinguishing between the siting alternatives.

However, community safety was identified as a key concern of many consultees and therefore a key factor to be addressed in facilities design and the development of operational procedures.

Subsequent to the initial QRA, a further QRA study was undertaken following the selection of the Best Shipping Alternative as the Selected Project Site as part of the process of verifying this selection (see Section 2.3.3).

In accordance with the Angolan legislative requirements, company and international standards, further QRA studies will be undertaken as required during the engineering design and ESHIA process.

4.4.6 Results of the Evaluation

A brief summary of the results of the evaluation is presented here. It should be noted that the site alternatives are discussed in comparative as opposed to absolute terms and they were ranked as preferred, acceptable and least acceptable. For example all alternatives may have potential secondary impacts to some of the mangrove areas due to wake wave effects that would need to be mitigated.

The site selected, the Best Shipping alternative, represents the best available alternative for the Angola LNG Project, with particular reference to the principal project acceptability boundaries set for the Angola LNG Project, namely, alignment with World Bank Guidelines and Policies and acceptable public safety risk (see Section 4.4.1).

If for any reason the selected site is found to be inconsistent with the Project principle of choosing the site with the least environmental or social impacts, then remaining available sites would require further evaluation in order to identify the next best available alternative and necessary mitigation measures for such.

It is important to note that the above conclusions apply only to siting the Angola LNG Project, comprising the facilities for LNG production, export and providing a major dredged channel for the tankers.

The requirement for major dredging and its potential effects on the natural environment and fisheries is a critical factor in making the Best Shipping alternative the preferred alternative for the Angola LNG Project development. However, this would not preclude the other alternatives (or others nearby) from appropriate development that did not require such major dredging.

Refer to Figure 4-2, Site Alternatives, for clarification of site locations discussed below.

4.4.6.1 Low Tech Alternative

From the socioeconomic perspective the Low Tech site is considered to encompass agricultural land of good quality for the Soyo area. A preliminary site survey identified that a significant number of people from the local communities work the land on the Low Tech site or are engaged in fruit and wood collection and charcoal production. The Low Tech alternative was therefore deemed likely to have significant impacts to land-based livelihoods, fisheries, a cultural site, and the natural environment. Therefore it would require a physical and economic resettlement effort, the scope of which would need to allow for maintaining a suitable buffer zone to ensure an acceptable level of public safety. Secondary effects to nutrition due to loss of agricultural land and fisheries could also result. These impacts would be associated both with the direct footprint of the development site and the dredging of the entire Pululu channel and the attendant direct and indirect impacts to the mangroves. A number of cultural sites were also identified in this area. Coastal morphology could also be significantly impacted by the choice of this option.

From an environmental impact perspective, this option would lead to the significant alteration of wetlands, especially mangroves associated with accommodating the shipping channel and ship turning basin required in the Pululu Channel.

While some of the impacts are amenable to mitigation (e.g, economic and physical), impacts to local fishermen can be mitigated through implementation of a Resettlement Action Plan. Others, especially those associated with habitat loss and dredging would be costly to implement and their full success difficult to guarantee.

From the perspective of the potential to promote economic growth the key concern would be that the Lower Pululu Channel area would become a major port area, which could lead to further alteration to the mangrove habitat. However, there is land area available for potential future expansion of the LNG facilities and for the development of secondary industrial facilities.

As suitable alternatives are available that would lead to no or much reduced, resettlement, then the Low Tech site is less preferable for LNG project purposes from the point of view of socioeconomic impacts. As suitable alternatives are available that would not require alteration of wetlands, especially mangroves, the Low Tech site is also less preferable than the other three options from the point of view of environmental impacts.

4.4.6.2 Channel Alternative

The Channel alternative is deemed to have socioeconomic and environmental impacts similar in nature to those associated with the Low Tech alternative although they are expected to be quantitatively less.

From a socioeconomic perspective the direct impacts to fisheries and to agricultural land and the associated secondary impacts to nutrition and human health are considered to be less than for the Low Tech alternative. However, both physical and economic resettlement would still be required.

From the environmental perspective, although potential impacts to the mangrove area could still be significant (especially direct mangrove loss on the development site), these are considered more amenable to mitigation compared to those for the Low Tech alternative.

From the perspective of the potential to promote economic growth the Channel alternative would have land available for secondary development in the immediate vicinity. However the location of the shipping access for this alternative is considered to be less than optimal.

The Best Shipping and Hybrid alternatives would involve less resettlement and have fewer direct environmental impacts on mangroves than the Channel alternative. Therefore, the Channel alternative is considered less preferable than these two sites for LNG project purposes from environmental and socioeconomic impacts perspective.

4.4.6.3 Best Shipping Alternative

The Best Shipping Alternative avoids the two key environmental and socioeconomic impacts (i.e., extensive resettlement and alternation of the mangroves) associated with the two other alternatives discussed above.

From a socioeconomic perspective, limited resettlement will be required. The focus will be on compensation for fisheries interference. No cultural sites have been identified, and the land is already allocated for industrial use. However, the site is in closest proximity to the more densely populated areas of the Soyo

surrounds, and therefore safety and communication of safety to local stakeholders are important issues for this alternative.

From an environmental perspective, no direct and minimal indirect damage to the mangrove is anticipated from this alternative.

From the economic growth perspective, the Best Shipping alternative has limited space available for future expansion of the LNG facilities or for secondary development and occupies land of value for other potential development. However, this limited land availability on Kwanda Island would not preclude the possibility of running a domestic gas pipeline from the LNG site to an industrial site elsewhere in the Soyo area.

As this alternative would lead to little or no disturbance to the mangrove area and to minimal resettlement, this site is preferred over the other available alternatives.

4.4.6.4 Hybrid Alternative

The Hybrid Alternative combines elements of the Best Shipping and Channel alternatives with the process facilities located on the Channel site, and the marine terminal and storage areas located at the Best Shipping Site (northern shoreline of Kwanda Base). The key differences compared to the Best Shipping and Channel alternatives are listed below:

- It would require less dredging than Channel alternative.
- It would occupy less potential development land on Kwanda Base compared to the Best Shipping alternative.
- Some of the perceived risk to the local community would be farther away from Soyo compared to the Best Shipping alternative.
- The pipelines from the plant to the marine terminal would comprise an additional loss of mangrove in comparison with Channel alternative.

From a socioeconomic perspective the footprint for the Hybrid alternative on the Channel Site would be smaller compared with the Channel alternative. Thus although resettlement would be required the scale is likely to be reduced compared with the Channel option. Further, the facilities could be planned so as to avoid the cultural sites known to be present on the Channel site.

From an environmental perspective less direct damage to the mangroves would result compared with both the Low Tech and Channel alternatives as for the Hybrid alternative, the storage area has effectively been transferred from the Channel site to the Kwanda Base, and less dredging of the Channel will be required.

4.4.7 Conclusions

From environmental and socioeconomic perspectives, and taking into account stakeholder views, the sites were ranked in the following order:

Best Shipping.....	Preferred
Hybrid.....	Acceptable
Channel.....	Acceptable
Low Tech.....	Least Acceptable

Channel or Hybrid could be made to work as sites for the Angola LNG Project subject to the following key assumptions on mitigation measures being implemented effectively:

- Development of a Resettlement Action Plan that provides the appropriate levels of compensation and assistance to those individuals who would require physical resettlement such that they are able to maintain and improve their livelihoods.
- Development and implementation of mitigation measures to minimize impacts on the mangrove habitats that may include environmental offsets for mangrove habitat loss.
- Development of appropriate measures for management of an extended and costly (relative to the Best Shipping option) dredging program.

It is important to note that the above conclusions apply only to siting the Angola LNG Project, comprising the facilities for LNG production, export and providing a major dredged channel for the tankers.

The requirement for major dredging and its potential effects on the natural environment and fisheries in the Pululu Channel is a critical factor in making the Channel, Low Tech and Hybrid sites less acceptable for the Angola LNG Project development. However, this would not preclude these sites (or others nearby) from appropriate development that did not require such major dredging.

4.4.8 Final Site Selection Decision

In early May 2004 the Angola LNG Project partners agreed that the most viable location for the Angola LNG Project was the Best Shipping (Selected Site). The recommendation to locate the project at the Best Shipping site was based on the agreement that the site had:

- The lowest environmental and socioeconomic risk.
- The lowest safety/operability risk.

- The highest conformance to World Bank Guidelines and Policies.
- The most technically suitable location.

In addition to all the previously mentioned studies, the project team undertook a quantitative environmental risk assessment of the sites under consideration. This assessment was conducted using experts in mangrove areas, wetlands, and other environmental specialists. The conclusion reached from this risk assessment was that the Best Shipping alternative represented the least environmental risk for the Angola LNG project.

The Best Shipping alternative was recommended on the assumption that a range of mitigation measures would be put in place to ensure that any environmental and socioeconomic impacts are minimized and that the project fully explores all opportunities to promote secondary development and economic growth in the Soyo region. An overview of the proposed mitigation measures is provided in Section 6.0.

Biodiversity conservation is an integral part of the Angola LNG Project.



5.0 THE ENVIRONMENTAL & SOCIOECONOMIC CONTEXT TO THE PROJECT

5.1 Introduction

The information used in this section has been obtained from a number of sources including:

- Published literature.
- Other studies commissioned by Angola LNG.
- Studies by international and local consultants carried out during the site selection process.
- Local consultations carried out during the site selection process

The list of references, reports and data sources may be found in Appendix A to this document.

The proposed location for the onshore Angola LNG development is shown in Figure 5-1. The area is on the southern side of the mouth of the Congo River (see also Figure 5-3).

5.2 Environmental Summary

5.2.1 Site Setting

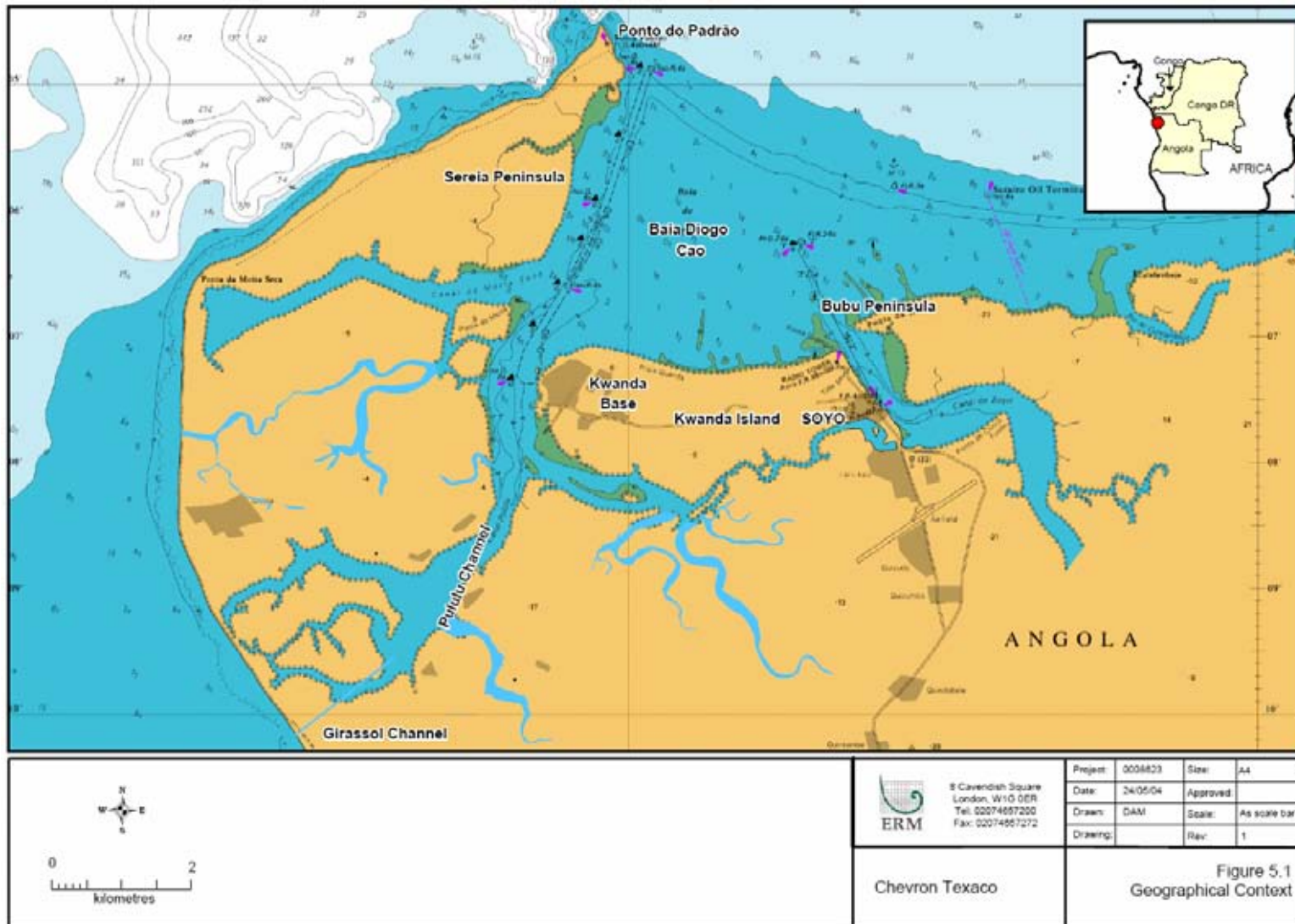
The proposed location of the Angola LNG Project (Figure 5-1) is almost entirely protected from the influence of Atlantic storms and waves, by the Sereia Peninsula.

The Atlantic coastal fringe area to the west consists of a steep sandy beach backed by a low, red sandstone cliff. This cliff gives way northwards to a low sand ridge immediately behind which the land slopes down to an area of mangrove. The eastward migration of this beach is evident particularly near Ponta do Padrão.

Inland of the beach, there is an area of mangrove intersected by channels. The mangroves are bounded in the east by the Pululu Channel and to the south, by higher ground, which is partially inhabited and cultivated. Within the mangroves, there are slightly raised areas some of which are also inhabited and cultivated.

To the south of this area there are further mangroves and mangrove channels, which grade into the higher, partly cultivated land. This higher, cultivated land extends further south and west to the sea becoming an area of cultivated grassland/forest below the mangrove area as a whole.

Figure 5-1: Geographical Context



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To the east of Ponta do Padrão and north of the mouth of the Pululu Channel the main shipping channel for the supply base at Kwanda runs southwest to northeast. This channel was dredged to around 8 m minimum depth in 1989 and now requires ongoing maintenance dredging. Further to the east, the shallow area of Baía Diogo Cão is bounded on its southern side by Kwanda Island. The existing port facilities at Kwanda Base are located at the western end of Kwanda Island.

To the south of the Kwanda Base access road there is an area of mainly dwarf mangrove. The town of Soyo is located to the east of the mangroves.

The more open waters of the Baía Diogo Cão in the vicinity of the proposed Angola LNG site are less sensitive to disturbance than the more enclosed channels in the mangrove areas. The area of coast adjacent to Kwanda Base is thought to have a tidal circulation, albeit with slow tidal currents, and therefore a more dynamic geomorphological and sedimentation regime. This indicates that the area is of low sensitivity to disturbance through activities such as dredging and reclamation, and due to the dynamic sedimentation regime recovery is likely to be faster.

5.2.2 Climate

The coastal climate of the general project area in which the selected site is located is controlled by seasonal fluctuations in interactions between the ocean and atmosphere. The coastal area of Angola north of 12°S to Cabinda has a hot, humid climate. At Soyo, the mean daily temperature is 21.2°C in winter (June-August) and 28.2°C in summer (Nov-March).

There is a relatively steep latitudinal gradient in rainfall along the Angolan coast with rainfall at Soyo typically in the order of 600 mm yr⁻¹. The dry season is also experienced at different times of the year along the coast; for Soyo it occurs between May and August (WCMC, 2002).

Winds blow mainly from the south along the coastline. The predominant winds are southerly and southwesterly blowing steadily between 5°S and 30°S throughout the year (African Pilot 1977). A meteorological data station is currently in place in the Soyo area, and detailed data will be collected for a minimum of twelve months.

5.2.3 The Offshore Environment

5.2.3.1 Offshore Seabed Characteristics

The bathymetry of the offshore project area is characterized by the continental shelf, which varies in depth. The shelf break occurs in approximately 100- 200 m water at between 30-40 km offshore (PIO 2002). Beyond this depth the seabed slopes down to 5000 m in the Angola Basin, more than 2000 km offshore.

Generally offshore gas pipelines will be laid in waters of depth up to approximately 1,400 m.

A key feature of the bathymetry in the area is the Congo (Zaire) canyon. The Congo River has the second highest river discharge volume in the world, comprising an average discharge of $41,000 \text{ m}^3 \text{ s}^{-1}$ of water and 41 million metric tones per year of suspended sediment. This sediment is carried west-northwest in the nearshore waters and south-southwest in the offshore waters. The canyon itself represents a significant challenge to offshore pipeline design and construction.

The continental slope elsewhere is characterized by extruding salt 'mounds', pockmarks (possibly left by the natural release of gas from the seabed), and the sediment discharged from the neighboring mainland via the river induced formations. Along the continental slope bottom, current activity is believed to have a minor influence on the seabed features in the area.

The section of coast between Ponta das Palmeirinhas and Cabinda is characterized by large areas of fine to coarse sand. Silt is found outside the Congo River estuary, south of Cabinda and north of Luanda. Beds of stone, rocks and corals interrupt these areas. Areas of harder substrate may be associated with fishing grounds for crustaceans.

5.2.3.2 Offshore Marine Biodiversity

There is a relatively large sea turtle population distributed along the coast and in the offshore waters of Angola. The five species present are protected species. They are listed in Table 5.2. The general feature of all these species is their relatively limited presence in offshore and coastal waters between April-September in comparison to their nesting period during the rainy season (October-February). Based on preliminary consultations it is understood that turtles nest on the beaches along the Sereia Peninsula, seaward of the Soyo area.

A variety of marine mammals are present in offshore Angolan waters. Notable species include humpback whales, which are reported (Morais, 1998) to potentially breed in these waters, and migrate to and from their Antarctic winter-feeding grounds through Angolan waters.

The Angolan coast is generally important for birds and a number of species are present some distance offshore, including various species of petrel and shearwater.

5.2.3.3 Marine Fisheries

The commercial fisheries sector in Angola is the third most important industry behind oil and diamond mining. It provides an important source of employment and supplies over 50% of the animal protein to the country (Hampton, 1999).

The two main species exploited are juvenile Cunene horse mackerel and herring. Other important fisheries targets include sardine and deep-water prawns, tuna and crab.

The main fishing gear types used in Angolan waters are:

- Pelagic longlines comprising hooks, 10s of km's in length, which fish for tuna and tuna like species between 50-175 m depth.
- Pelagic purse seiners comprising large nets that can fish in 300 m depth and fish for mackerels, sardines and sardinellas.
- Demersal trawls which fish along the bottom at depths of up to 600 m, but usually in depths of up to 400 m.
- Pots for crab.

Under agreement with the government of Angola a number of foreign vessels exploit Angolan waters, including vessels from European Union countries.

The inshore waters off the Angolan coast represent an important fishery for artisanal fishing vessels. Artisanal vessels operating off Angola are estimated to be approximately 4,500 vessels comprised of the following:

- Un-motorized canoes (25% of total).
- Chatas (small wooden boats without motors comprising 70% of total).
- Catrongas (8-12 m length vessels with inboard engines).
- Traineiras (larger 8-25 m semi-industrial vessels).

The main target species include sardine, sardinellas, horse mackerel, tuna, grouper, bigeye dentex and mullet. These fish are caught with a range of fishing gears including longline, gillnets, and seine nets (Hampton, 1999).

Based on preliminary consultations it is understood that there is not currently a significant marine fishing industry in the vicinity of the proposed project location.

5.2.4 The Coastal and Terrestrial Physical Environment

5.2.4.1 Mangroves

Mangroves in West Africa extend from Île Tidra in Mauritania south to Lobito in Angola and cover 31,000 km² (CSIR, 2003). There are only five species of mangrove in the West African mangrove flora, all of which are present in the Congo Estuary. It is expected that these are all present in the Soyo area, although the preliminary habitat surveys undertaken on behalf of Angola LNG indicate a predominance of the genus *Rhizophora*.

Mangroves in the broad Study Area form part of the Congo Estuary mangrove forest, which extends both north and south of the river. The mangroves of the Sereia Peninsula and south of Kwanda Base occupy roughly 39 km². This is relatively small (8%) in relation to the wider mangrove resources (i.e. the Congo Estuary as whole), but represents a significant habitat locally.

Results of remote sensing suggest three main categories of mangrove habitat as follows:

- **Tall**, corresponding to trees which are over 20 m high growing in dense stands. These are most likely to be *Rhizophora racemosa*.
- **Intermediate**, which are between 4 and 6 m high, most likely to be *R. racemosa* and *R. harrisonii*. In some locations the intermediate mangrove has a conspicuous terrestrial component the principal constituents of which are the fern (*Bolbitis auriculata*) and the thorn bush (*Drepanocarpus lunatus*).
- **Dwarf**, which are small shrub like trees, 2 m high and separated by comparatively large areas in relation to the height of the trees. These are likely to be predominantly *R. mangle*.

The distribution of the main mangrove habitats found in the area, and other habitats of note are shown in Figure 5-2. These habitat types correspond to the observations made during the field studies. Some areas in front of the young trees are densely populated by emergent grasses of two species: *Spartina* sp and a broad bladed species, which has not yet been identified.

The general area in which the Angola LNG Project is proposed includes some 'intermediate' mangroves. However the areas affected are relatively small and isolated and it is thought the habitat has been exposed to past disturbance. As a result, the habitat is likely to be of low value and there is a low possibility of any protected species in the area.

Maritime forest remnants have been identified on the higher land to the south of the Pululu Channel. Other than this, the terrestrial habitat is generally of limited conservation interest.

5.2.4.2 Freshwater and Brackish Habitats

The Pululu Channel and the mangrove channels of the Broad Study Area have a range of different aquatic habitats defined by the wide variation in bathymetry, sediment type, current velocity and salinity. Within the Pululu channel there are banks of muddy sand with algae and some areas of sea grass, though the extent and species are not known. It is predicted that these areas are confined to shallow shoals in the Pululu channel of less than 2 m below chart datum (CD). Shallow areas in the Baía Diogo Cão are less likely to have sea grass due to softer sediment, greater turbidity and increased wave action. No sea grass or macroalgae were observed growing along the channel shore.

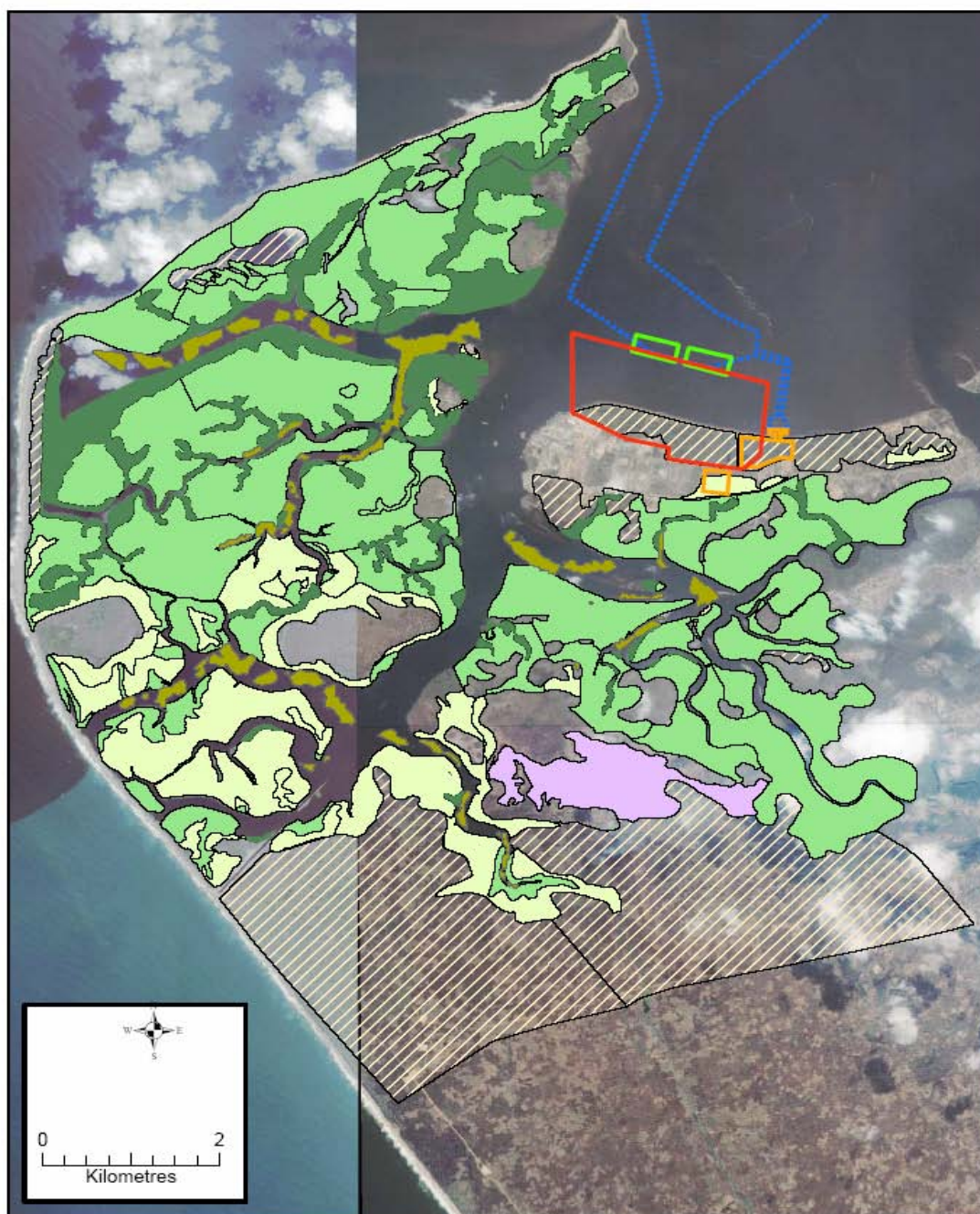
The mangrove channels are likely to be important for aquatic species, particularly spawning and juvenile fish. It is well known that mangroves can increase the abundance and diversity of fish fauna as a consequence of their role as spawning and nursery habitat. Consequently the mangrove habitats are important for both the fisheries resource of the general Congo Estuary area and for local biodiversity. The results of consultations with Pesnorte (an Angolan fishery organization) confirm the importance of the Congo Estuary as a spawning and nursery area for fish. Available data indicate that the annual local catch corresponds to an estimated 100 kg ha⁻¹ mangrove.

Although there is very limited information available on the abundance and distribution of the various fish species that occur in the broad Study Area, data collated from local fish catch results suggests that at least 20 species occur in reasonable numbers. These are summarized in Table 5.1.

5.2.4.3 Coastal Fringe Habitats

The key geomorphological sensitivities along the coastal fringe of the Sereia Peninsula include sand dunes and lagoons. An extensive range of sand dunes runs north to south along the Peninsula and coastal lagoons are found immediately adjacent to the dunes on the inland i.e. mangrove side, of the peninsula as previously mentioned. Up to five species of turtle (all of which are protected under IUCN classification) use the Atlantic fringing beach southwest of Ponta do Padrão as a nesting site. The most active period of nesting is between October and February.

Figure 5-2: Habitats in the Region



 Laydown and Construction Area	 Tall Mangrove	 8 Cavendish Square London, W1G 0ER Tel: 02074657200 Fax: 02074657272	Project: 0009623	Size: A4
 Fence Line	 Intermediate Mangrove		Date: 24-05-04	Approved:
 Offshore Berths	 Dwarf Mangrove	Drawn: DAM	Scale: As Scale Bar	
 Dredging Channel	 Sub littoral Habitat	Drawing: Habitats	Rev: 2	
	 Study Areas	Chevron Texaco Figure 5.2 Habitats in the Region		
	 Maritime Forest			
	 Shrubland			

Table 5.1: Fish in the Coastal/Congo Estuary Study Area

Species	Local Name	Comments
<i>Argyrosomus hololepidotus</i> , <i>Miracorvina angolensis</i> , <i>Pseudotolithes brachygnathus</i> , <i>P.</i> <i>longates</i> , <i>P. epipercus</i> , <i>P. moori</i> , <i>P. senegalensis</i> , <i>P. typus</i> , <i>Atractoscion aequidens</i>	Corvina. Large individuals called Pungo. All are sciaenids (drums and croakers)	Thought to be the most abundant group of species in the Soyo area. Exact distribution information is not available but these species are thought to be widespread in the Pululu Channel and surrounding waters. Large individuals less abundant
<i>Cephalopholis niger</i> , <i>C. taeniops</i> , <i>Epinephalus aeneus</i> , <i>E.</i> <i>alexandrinus</i> , <i>E. goreensis</i> , <i>E.</i> <i>gauz</i> , <i>Mycteroperca rubra</i>	Garoupa (groupers)	Less abundant species, but thought to be widespread in the area.
<i>Dentex macrothalmus</i>	Cachucho (sea bream or bigeye dentex)	Less abundant species, but thought to be widespread in the area
<i>Pomadasyes Jubelini</i> , <i>P. Peroteti</i> , <i>P. Rogeri</i>	Roncador (grunts)	Occur in only limited numbers in the Soyo area. These are not thought to be a significant species in the area.

5.2.4.4 Habitat Designations

Neither the maritime forest remnants nor the Soyo mangroves are currently designated by the Angolan Government or international governmental conservation bodies. At present, there is no mechanism within Angola for the systematic evaluation and designation of areas for conservation importance. It is understood that the area may be subject to some form of designation in the future. Birdlife International (a recognized international NGO) has designated the entire Angolan Coast north of the Namibian border, an area of some 150,000 km², as an ‘*Endemic Bird Area*’ (EBA).

5.2.4.5 Protected Species

There is a general paucity of data regarding the biodiversity of the Angolan side of the lower Congo River. The few data available do not specifically indicate resident populations of rare, endangered or protected species, though a number of rare or protected species have been identified which may potentially use the area. These are listed in Table 5.2.

Table 5.2: Rare, Protected or Endangered Species that may be Present

Species	Location/Comments	IUCN Status*
REPTILES		
Green turtle <i>Chelonia mydas</i>	Reported to nest on the beaches from the Sereia Peninsula southwards. No records of turtles nesting on the inner coastline of the peninsula.	Endangered
Leatherback turtle <i>Dermochelys coriacea</i>	Reported to nest on the beaches from the Sereia Peninsula southwards. No records of turtles nesting on the inner coastline of the peninsula.	Critically Endangered
Loggerhead turtle <i>Caretta caretta</i>	Reported to nest on the beaches from the Sereia Peninsula southwards. No records of turtles nesting on the inner coastline of the peninsula.	Endangered
Olive ridley <i>Lepidochelys olivacea</i>	Reported to nest on the beaches from the Sereia Peninsula southwards. No records of turtles nesting on the inner coastline of the peninsula.	Endangered
Hawksbill turtle <i>Eretmochelys imbricata</i>	Reported to nest on the beaches from the Sereia Peninsula southwards. No records of turtles nesting on the inner coastline of the peninsula.	Critically endangered
BIRDS		
Golden backed bishop <i>Euplectes aureus</i>	This species has been observed in the Soyo area and it is likely that a resident population exists in the area. The species is unlikely to be found in mangrove vegetation but may exist in undisturbed forest areas.	Lower Risk (near threatened)
MAMMALS		
West African manatee <i>Trichechus senegalensis</i>	Manatees are known to exist in the Congo River system and local fishermen using both the Congo Estuary and the channels of the Sereia Peninsula have reported their presence.	Vulnerable
Giant otter-shrew <i>Potamogale velox</i>	Due to the level of human activity in the Sereia Peninsula it is likely that any surviving populations of shrew are present in very low numbers. Any surviving populations would be most likely found in undisturbed mangrove/shoreline vegetation.	Endangered
Spotted-necked otter <i>Lutra maculicollis</i>	Due to the level of human activity in the Sereia Peninsula it is likely that any surviving populations of otters are present in very low numbers. Any surviving populations would be most likely found in undisturbed mangrove/shoreline vegetation.	Vulnerable
Congo clawless otter <i>Aonyx congicus</i>	Due to the level of human activity in the Soyo area it is likely that any surviving populations of otters are present in very low numbers. Any surviving populations would be most likely found in undisturbed mangrove/shoreline vegetation.	Data Deficient
Yellow-backed duiker <i>Cephalophus silvicultor</i>	Due to the level of disturbance of its natural habitat in the Soyo area it is highly unlikely that and populations of duiker will have survived in the area.	Lower Risk (near threatened)
* IUCN: The IUCN Red List of Threatened Species, 2003		

The likely presence of West African manatee (*Trichechus senegalensis* - known locally as peixe mulher or porco do mar) is of particular note. It is classified as vulnerable by IUCN (based on a 20% decline in numbers over 10 years), listed as Appendix II by CITES and overall regarded as the most threatened of all manatee species. Threats to manatees across its range from Mauritania to Angola include: direct hunting and fisheries by catch; habitat loss; habitat degradation; pollution and general burden on West African wetlands due to human development. In the broad study area, local people have observed manatee presence over the years. Anecdotal accounts suggest frequency of observations have reduced in recent years.

Casual observations made during fieldwork for the site selection indicate that the area is used by a number of other bird species. Though the importance of the area for birds cannot be definitively established from such observations, it suggests that the Soyo mangroves are similar, in terms of bird fauna, to the mangroves of the Park des Mangroves in the Democratic Republic of Congo (DRC), which is designated as a Ramsar site. Ramsar sites are designated under the *Convention on Wetlands of International Importance, Especially as a Wildfowl Habitat*. Angola is not a signatory.

There is very little information regarding the presence and distribution of any of the other threatened or near threatened species in the vicinity of the proposed project location but on the basis that the area has been largely developed previously it is highly unlikely that any resident populations occur.

5.3 Socioeconomic and Community Health Summary

5.3.1 National Overview

Angola achieved independence from Portugal in 1975, but experienced a 25-year civil war until a peace accord was signed in 2002. The civil war has left Angola economically underdeveloped. In the 2003 UN Human Development Index, it was ranked 164 out of the 175 countries assessed and the World Bank estimates that 2 million people depend on international aid (World Bank, 2003)

Infrastructure in general, including roads, electricity, water supply, waste disposal, health care and telecommunications has suffered as a result of the civil war, with much destroyed or simply not maintained. Vast areas of the country still contain UXO and are therefore unusable to inhabitants. This has reinforced the urbanization trend (Angola has a population of approximately 14 million, approximately a quarter of whom live in Luanda).

Angola has a highly centralized government structure. While there is a democratically elected national government, authorities at the regional and municipal level are largely still appointed by this central authority.

Angola is the second largest exporter of oil in Africa but is not a member of OPEC. The oil industry currently accounts for 60% of GDP and 85% of government revenue and is the second largest exporter of oil in Africa². Oil production in the country is set to double over the next five years.

The country suffers from high rates of both unemployment and underemployment (approximately 40%). 26% of the Angolan population lives in absolute poverty³. According to the World Bank, there is a large informal sector of the economy as a result of economic uncertainty brought about by the civil war, and the time necessary to properly re-establish governmental institutions following this period.

5.3.2 Province of Zaire Overview

Zaire Province is one of 18 Provinces of Angola and has an area of 40,130 km². This is approximately 3.2% of the total land area of the country. The Province borders the Atlantic Ocean to the west and the DRC to the north. To the south is the province of Bengo and to the east the province of Uige.

The province has 6 municipalities including Soyo (the others being N'Zeto, Tomoboco, M'Banza Congo, Noqui and Cuimba) and 24 communities. The city of M'Banza Congo (see Figure 5-3) is the provincial capital with an estimated population of 40,000 (Ministry of Planning, June 2003).

According to the National Statistics Institute, in 2001 the Province of Zaire had a total estimated population of 288,372 inhabitants, with a population density 7.8 inhabitants/km².

The Province of Zaire is marked by distinct inequalities between municipalities both in respect of population density and economic development. More than half of the population is concentrated in the urban areas of M'Banza Congo and Soyo. Education and health services are generally poorly developed, and some of these services are scarcely available in other municipalities. As a result of this, the lack of investment in education in rural areas has resulted in the migration of school age children to the cities, causing problems of overcrowding.

Infrastructure in Zaire Province is generally in poor condition – if compared with large areas of the rest of the country. For example, according to the Provincial Public Works and Urbanization Department, of the existing 1,638 km of highways,

² Foreign and Commonwealth Office, 2004

³ Long Term Development Plan of the Republic of Angola, Ministry of Planning, October 2002

1,506 km are in need of repair. This is a factor which severely restricts economic activity.

The Province of Zaire has a maritime port in Soyo where much of the merchandise and people enter and leave the area. Commercial operators and the petroleum industry are the main users of this port.

5.3.3 Cultural Heritage in Soyo

The Soyo Municipality is located in Zaire Province in the northwest of Angola (see Figure 5-3).

Soyo is the development centre of Zaire Province largely due to its oil and gas resources and associated developments. Other areas, including the capital M'Banza Congo, have very few industrial growth activities. Maritime communications are relatively well developed in Soyo and other infrastructure and services are also better developed than in other parts of the Province.

The Soyo municipality is divided into five communes: Pedra do Feitiço, Sumba, Quelo, Manga Grande and Soyo. Of the approximately 110,000⁴ inhabitants of Soyo Municipality, an estimated⁵ 25,000 in 2000 (predicted to increase to 60,600 inhabitants in 2020⁶) live in Soyo town. However given the current high levels of population movement, including returning refugees and in-migration, all of these numbers should be considered broad estimates and are subject to rapid change.

The remaining inhabitants live in the *aldeias* (villages) along the main roads. The Soyo area is divided into aldeias each of which has a traditional chief or 'Soba'. These traditional leaders are still highly respected among the local populations, as is the spiritual leader (Rei do Povo) who presides over the Sobas. Individuals working on the land, fishing or undertaking other livelihood activities, generally use housing away from the main roads as temporary accommodation. In addition to Kwanda Base, settlements within or near the Best Shipping Study Area (i.e. on Kwanda Island) include:

- Songo Etona – approximately 10 buildings.
- Bumba Luka – approximately 21 buildings.
- Praia dos Pobres – approximately 17 buildings.

⁴ Zaire Provincial Government (Paul 2003)

⁵ Socioeconomic Development Program of the Province of Zaire (1999). Note that this program does not contemplate the development of the Angola LNG Project, nor other large industries in the Soyo area.

⁶ The population of Soyo Municipality is estimated to increase from 59,200 to 116,328 over this period (source as above).

- Kikala Kiako – approximately 230 buildings.
- Figo⁷ – approximately 19 buildings.

The people of the Zaire Province generally belong to the ethnic grouping of Mukongo (in the plural referred to as Bakongo)⁸. Kikongo is the local language, although Portuguese, the official Angolan language, is also spoken. In the Soyo area, the local dialect is Kisorongo.

5.3.4 Planning and Development in Soyo

Soyo has been identified as a preferred center for future industrial development⁹. The Angola LNG Project is central to this strategy as are the projected secondary industries that will use the gas or other outputs from Angola LNG. Potential secondary industries identified during consultation meetings include: ammonia, methanol, aluminum and fertilizer. There is no development plan to support this industrialization or the potentially significant increase in population that is likely to result¹⁰.

Plans for development in the area that have been shared with the Project team are as follows.

- Expansion of the commercial port facility at Kwanda Base.
- Construction of employee housing by Sonangol.

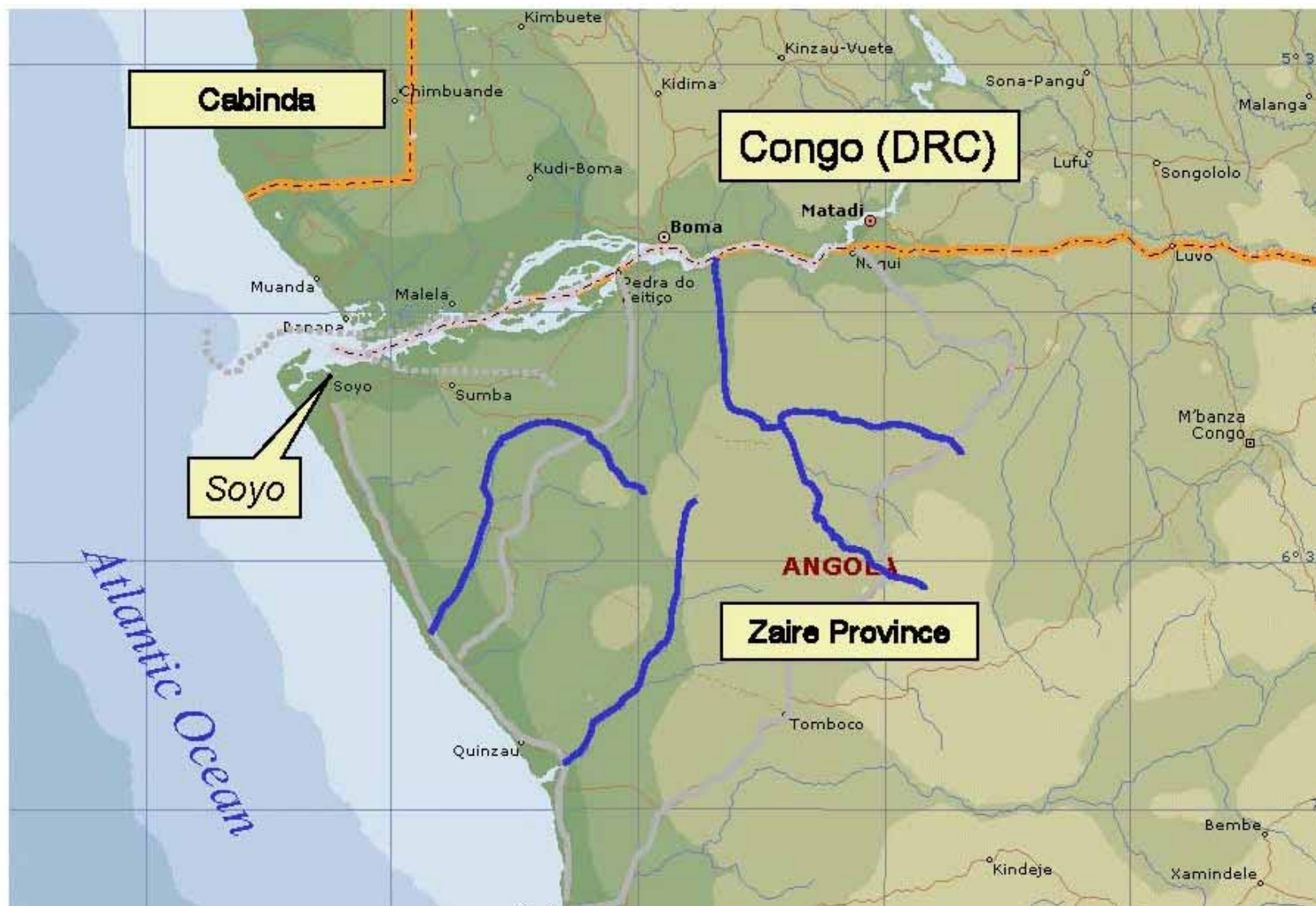
⁷ A fishing community located across the Pululu Channel.

⁸ Socioeconomic Development Program of the Province of Zaire (1999).

⁹ Consultation meeting, November 2003, Joint Ministerial Commission. Other potential development poles that have been identified include Luanda, Cabinda, Futila, Molembo, and Tambela.

¹⁰ The existing Soyo Planning document, (the Program of the Province of Zaire (1999) does not contemplate large industries such as Angola LNG and the potential secondary industries now being considered.

Figure 5-3: Zaire Province



Kwanda Island is already seen as developed and many local people hope to see developments in other locations nearer to where they live. Siting the LNG facility at Best Shipping will limit the ability to locate associated secondary industry adjacent to the LNG plant. However, a gas pipeline, roads or a rail link can be used to deliver raw products to secondary industries. The Project has committed to funding a secondary development study led by Sonangol to consider, among other issues, the location of secondary industry.

5.3.5 Economic Profile and Livelihoods in Soyo Municipality

5.3.5.1 Overview

The Soyo area has both unemployment and under-employment, particularly of young people. Subsistence farming and fishing are the main sources of livelihood for the majority of the population in Soyo and the surrounding areas, along with trading. Some public civil servants carry out government, education and health related activities in Soyo and some inhabitants work at the Kwanda Base (see below).

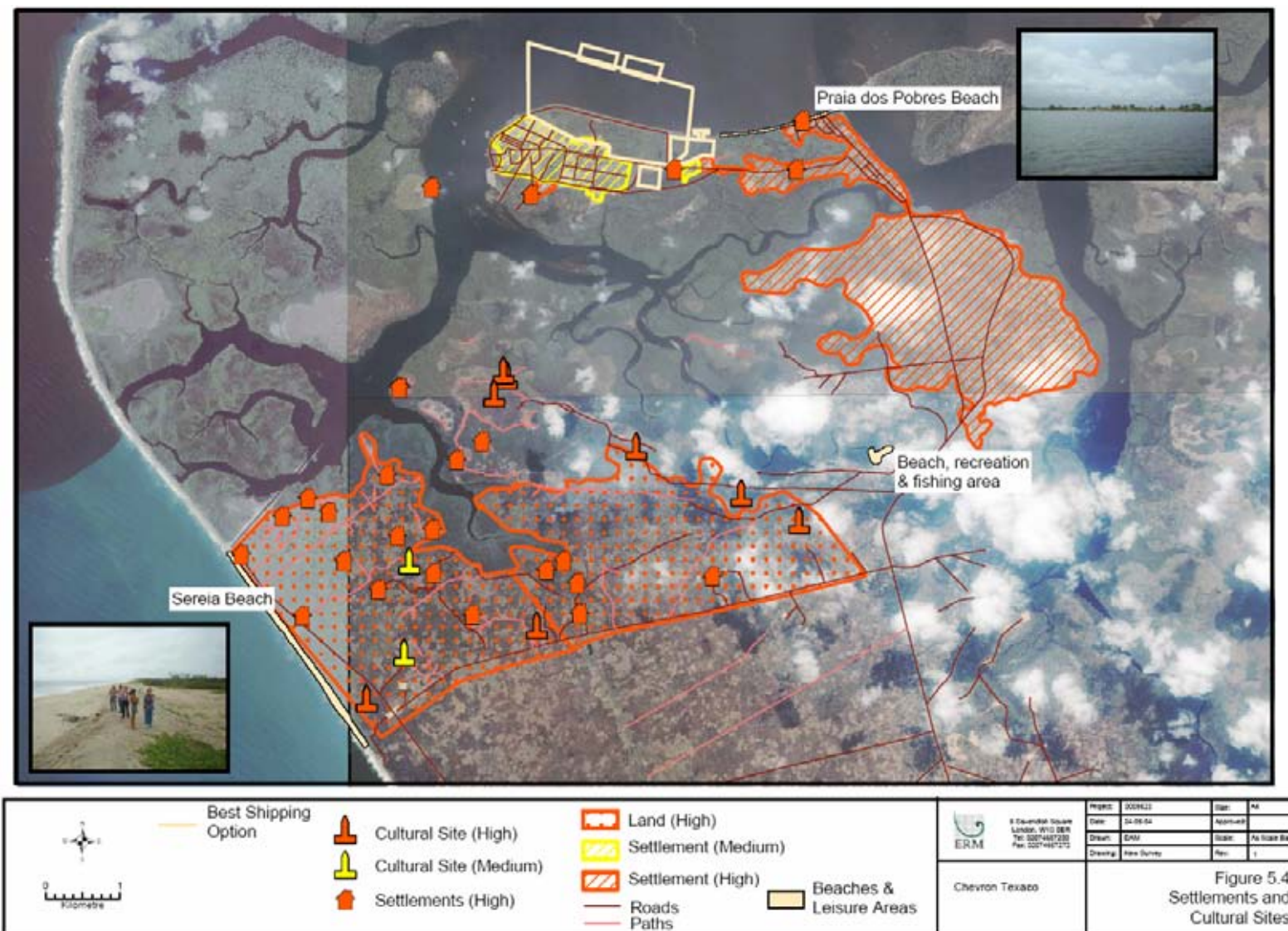
5.3.5.2 Industry

There are no factories in Soyo, but there are a number of small businesses and some crafts including wood and ivory craftwork and paintings.

Hydrocarbon developments in the Soyo area include offshore and onshore operations. A number of offshore operators carry out onshore activities at Kwanda Base on Kwanda Island. Kwanda Base was established as an operational and residential safe haven during the civil war and includes the commercial port activities. Interaction with the town has been limited and few supporting industries have developed in the area.

The siting of Angola LNG in the Soyo area has been driven partly by the government to encourage economic development in Soyo. The Angolan Government views the Angola LNG Project as a development that will catalyze the industrialization of Soyo. Secondary industries are already being evaluated that will utilize the products and by-products of the facility, for example gas and potentially sulfur. The Angola LNG Project is financially supporting a study to assist Sonangol and the government with responsible and sustainable development of the area.

Figure 5-4: Settlements and Cultural Sites



The oil industry provides a limited number of jobs to the local population. These are generally jobs that require only a basic to medium level of education, for example production operators, electricians, mechanics, welders, painters, masons, drivers, heavy machine operators, cooks, and catering staff. Few women are employed on Kwanda Base.

5.3.5.3 Land-Based Livelihood Activities

Women are the main agricultural workers, assisted at times by their children and occasionally by male family members. Most families tend to live in Soyo or the surrounding *aldeias* located along the main paved road between Soyo (in the north) and Pangala and travel to the fields each day. Some women are able to travel on communal transport to the fields, but many women walk, up to 15 km each day to reach their plots of land.

The most important crops in the Soyo area are manioc or cassava, peanuts and cashew nuts, however the range of crops grown also includes tomatoes, bananas, sugar cane, papaya, sweet potato, mangoes, baobab, date palms, ivory palm, and onions. Some animal husbandry is undertaken including goats, chickens and ducks¹¹.

Other activities carried out on the land include: gathering of fruits (for sale and to make ice-cream), wood cutting and charcoal production.

There is no evidence of agriculture in the Best Shipping Study Area beyond extremely small-scale plots in back yards or gardens, which are generally used to grow vegetables or peanuts.

5.3.5.4 Fishing

Fishing is one of the primary activities in the Soyo area, due to its proximity to both the Atlantic Ocean and the River Congo. Male family members using dug out canoes and simple equipment exclusively carry out fishing. A range of fish are caught and used for food, sold fresh or dried and taken to market either near Soyo or to Malongo and in the DRC. Fish caught include eel, tilapia, catfish and kingfish.

Some households rely almost exclusively on fishing (e.g. communities on Ponta do Padrão). These fishermen tend to have larger motorized canoes and mainly fish in the open sea, remaining in the mangrove channel areas only when they are not able to go out to sea. Other households fish as one of a number of sources of livelihood

¹¹ ERM / local consultant surveys (November 2003 and February 2004).

and use smaller non-motorized canoes. They generally remain in the channel areas, only rarely using the river area or open sea. Records for 2002 indicate that there are approximately 4,000 fishermen in Zaire Province and between 500 and 1000 people are involved in fishing in the Soyo municipality¹².

The fishing industry also provides some further indirect employment in services such as salt production, repair and production of gear, fish processing activities and marketing.

5.3.5.5 Recreation and Amenity

The local population of Soyo uses a number of beaches, particularly at weekends and holidays. The most favored beach is that on the Sereia Peninsula, which is a large sandy beach facing the ocean. However, this requires a car to access. Consequently those in Soyo main town also use Praia dos Pobres (beach of the poor), although water quality studies indicate that the water is polluted with human waste¹³ among other contaminants. In addition, there are a number of 'leisure areas' along the channels used for both washing clothes and bathing and finally a number of football pitches.

Hotels and guesthouses are located in the centre of Soyo town, at the eastern end of Praia dos Pobres (Sonangol guesthouse) and on Kwanda Base.

5.3.6 Health

Key national health statistics for Angola are summarized below in Box 5.2.

Box 5.2: Key National Health Statistics

- Life expectancy at birth is estimated at 37 years in 2003.
- Estimated HIV prevalence rate amongst adults is 5.5%.
- In 2002, 38% of the population had adequate access to water.
- In 2001, infant mortality was 154 per 1000 live births; under 5-mortality was 260 per 1000 children.
- 8,773 malaria cases occur for every 100,000 people each year.

Source: World Bank, 2002

¹² Paulo, 2003

¹³ CSIR, 2004

Health issues in the Soyo municipality are closely related to environmental issues. The sewerage system is limited and few houses in the Soyo area have sanitation. Waste disposal can be a key health issue because of the numerous informal waste dumping areas throughout Soyo potentially impacting people, water quality, and fish stocks. Nutritional status is marginal with subsistence agriculture and fishing forming the mainstay of the local diet. Mosquitoes are a problem in the area and there is no widespread mosquito control program.

Initial inquiries¹⁴ indicate that the key health issues for local communities appear to be malaria, sleeping sickness, maternal and sexual health, diarrhea, anemia, nutritional deficiencies, and some respiratory diseases in children.

Box 5.3: Key National Health Issues in Angola

- **HIV⁽¹⁾**: Almost one million people in Angola are infected with HIV, and it is expected that the disease could spread rapidly. Between 5% and 8% of HIV cases are in Luanda, where the highest population resides. As a boundary province of Luanda, Zaire Province is one of the most highly HIV- affected provinces in Angola partly due to migration.
- **Malaria⁽²⁾**: Malaria is endemic in Angola and is the highest causes of morbidity and mortality among all reported communicable diseases. Approximately 1.4 to 2 million cases per year have been reported by the South African Malaria Control Organization.
- **Tuberculosis⁽³⁾**: There were 197 cases per 100,000 people reported in 2001. Tuberculosis affects primarily the diamond prospecting areas due to poor diet and a lack of medical care.
- **Sleeping Sickness⁽⁴⁾**: One fifth of the Angola population is at risk of infection from sleeping sickness, but only 6% have access to health monitoring and treatment. Of the 4 million that live in the 6 northern affected provinces (include Zaire Province), it is estimated that 2.5 million people are at risk of contracting sleeping sickness.

⁽¹⁾Center for Disease Control (CDC), 2004; ⁽²⁾www.malaria.org.zw; ⁽³⁾ United Nations Development Programme; ⁽⁴⁾ Angola National Institute to Combat and Control Trypanosomiasis

There are a number of medical facilities within the Soyo municipality including a local hospital, a number of local clinics and health facilities provided by some of the local missions and a number of privately operated clinics for employees working for the oil and gas industry. As with other areas of public infrastructure, the health care system is under strain with:

- limited access to primary health care and medical supplies;

¹⁴ ERM Consultation in November 2003.

- increased demands for humanitarian health care from people that previously resided in inaccessible locations; and
- increased numbers of returning and resettling populations in areas without adequate health care infrastructure.

5.4 Key Gaps and Deficiencies in the Data

5.4.1 Identified Data Gaps

This section has been prepared based on information provided by Angola LNG, initial consultation with the government and community leaders, and meetings with the engineering design teams.

The data gaps identified are indicated in the Table 5.3: Physico-chemical and Biological data and Table 5.4 Socioeconomic Data. Table 5.4 indicates the present status of information collection on a National (Angola-wide), Regional (Zaire Province) and Local (Soyo) level and also identifies where data collected is deemed sufficient for the purposes of the ESHIA.

The Tables are followed by a discussion of the strategies that will be initiated to fill these data gaps.

Table 5.3: Physico-chemical and Biological Data Gaps

Data Gap Issues – Physico-Chemical
Soil and groundwater chemistry in mangrove areas
Hydrology
Seasonal trends in water quality e.g. salinity, dissolved oxygen and suspended solids
Metocean data
Air quality
Background noise
Data gap Issues – Biological
Benthic ecology of offshore areas, Pululu Channel and mangrove creeks
Fisheries ecology and fisheries resources
Distribution and seasonality of cetaceans, turtles, and manatees
Ornithology
Mangrove ecology

Table 5.4: Status of Socioeconomic Information Collection Including Identified Data Gaps

Issue/ Sub Issue	National	Regional	Local
Historical & Geographical context			
Historical background	(✓)	(✓)	(✓)
Geography	(✓)	(✓)	(✓)
Demographics			
Population levels	✓	✓	(✓)
Age distribution	✓	✓	(✓)
Gender distribution	✓	✓	(✓)
Migration and IDPs	(✓)	(✓)	(✓)
Cultural Context			
Ethnicity	✓	(✓)	(✓)
Religion	✓	✗	(✓)
Language	✓	(✓)	(✓)
Customs, culture	✗	✗	(✓)
Cultural history, archaeology	✗	✗	✓
Economy			
Economic indicators	✓	✗	✗
Inflation	✓	✗	✗
Imports/ exports	✓	(✓)	✗
Labor force (e.g. unemployment etc)	(✓)	✗	(✓)
Sources of livelihood/ employment	(✓)	(✓)	(✓)
Businesses/ Industry	(✓-)	✓	(✓)
Fishing	(✓)	✓	(✓)
Agriculture	✗	✓	✓
Health			
Statistics	✓	(✓)	(✓)
Health care	✓	(✓)	(✓)
Health problems	(✓)	✗	(✓)
Education			

Issue/ Sub Issue	National	Regional	Local
Literacy	✓	✓	✗
Facilities	✓	✓	(✓)
Problems	✓	✓	(✓)
Social Networks and Recreation			
Social Networks	✗	✗	✗
Recreation	✗	✗	(✓)
Infrastructure & transport			
Water	✓	✗	(✓)
Sewage	✗	✗	(✓)
Waste	✗	✗	(✓)
Energy	✗	✗	(✓)
Telecommunications	✓	✗	✗
• Transport	(✓)	(✓)	(✓)
• Housing`	✗	✗	(✓)

Key: ✓ = data has been collected and is adequate for the ESHIA; (✓) some data has been collected but more detail is required for the ESHIA; ✗ no data has been collected.

A brief background to the above Table 5.4 is as follows:

Physical Capital

To date, only high-level information has been collected on infrastructure (e.g. roads and houses), utilities (e.g. water, waste) and equipment (e.g. boats, agricultural implements, bicycles, etc.). This issue will be explored further in the ESHIA. This data will provide material for the development of Indigenous Peoples or Resettlement Actions Plans, if required (see Section 6.0).

Human Capital

At this stage only broad estimates have been made of the population levels for each of the building groupings in the Study Area associated with the potential sites during the site selection process. In addition, only overview information has been collected on health, education and skills levels through consultation with health care staff, teachers from the training school ADPP and secondary data collection. Additional data specific for the selected site will be collected on demographic and migration patterns, available local skills, and education and health levels. This data will be pertinent to the screening exercise to determine whether or not Indigenous Peoples will be affected by the development and for scoping of the Indigenous Peoples and Resettlement Action Plan, if required (see Section 6.0).

Natural Capital

A detailed land ownership and use survey has not been carried out. Initial survey data indicates that land use is limited to small-scale vegetable gardens on Kwanda Island and there is no agriculture. The need or otherwise for a detailed survey will therefore need to be determined on the basis of whether or not the project would result in restriction of access to these areas or otherwise affect the resources on which the people depend for their livelihoods and whether or not the people using the areas are identified as Indigenous Peoples. These issues will be pertinent to the determination of the need or otherwise for Resettlement Action or Indigenous Peoples Plans.

With regards to fishing, it has not been possible to quantify the importance of the various fisheries areas in terms of intensity of use and fisheries catch. As part of the ESHIA process it will be necessary to determine whether or not there is a requirement to address fisheries issues in a Resettlement Action or Indigenous Peoples Plan. Data on fisheries resources and the fisheries value chain (i.e. repairing of nets, marketing of fish etc) will be essential to this.

Social Capital

At this stage, social networks, cultural ties to land and cultural values have not been researched in detail. Such information is essential for determining the need for and scope of Indigenous Peoples and Resettlement Action Plans, if required.

Financial Capital

Given the dependency of the Soyo Municipality on land, the focus of research has been on the importance of land and fish as a source of subsistence. The importance of other sectors as sources of employment and wage income will be explored during the full ESHIA including an assessment of local suppliers. Such information is essential for determining the scope of Indigenous Peoples and Resettlement Action Plans, if required.

5.4.2 Strategy for Filling Data Gaps

Available data will be studied in order to address the physico-chemical and biological data gaps that as well as confirming the validity of available data available. Fieldwork will be carried out to further characterize the terrestrial ecosystem within the sphere of the Angola LNG Project as well the Congo River estuarine environment. Air quality and noise baseline characterizations will be also carried out.

The collection of socioeconomic and health data to be carried out in connection with the full ESHIA will re-address all relevant issues but will bear in mind the identified data gaps and obtain where possible the missing information. The methods used will include consultation with stakeholders, field surveys and analysis of field data, and collection and review of secondary data sources.

The strategy employed will ensure that the level of information on all issues will be sufficient to robustly assess the impacts both positive and negative of the Angola LNG development.

6.0 IMPACT SCREENING AND ISSUES IDENTIFICATION

6.1 Introduction / Methodology

As stated in *Section 1.0*, a key objective of the scoping phase of the ESHIA process is to identify the most important issues for detailed consideration in the ESHIA. As the first step in this process the Angola LNG Project team has undertaken a preliminary evaluation of the potential impacts and issues associated with the Selected Project Alternative. The findings of this represent the current views of the Angola LNG project team, based on a combination of the information collated through the program of studies and consultation and disclosure undertaken to identify the Selected Project Site, past experience, professional judgment, and the current understanding of the engineering design.

The approach taken and findings of this process are presented in this section for review and comment by stakeholders.

The process of identification of the most important issues undertaken by the Angola LNG Project team was carried out in a systematic way, broadly involving the following three steps.

1. The environmental, socioeconomic, and health aspects and impacts (as they stand at the commencement of FEED) for the Angola LNG development were identified.
2. Current combined knowledge of the baseline environmental and socioeconomic sensitivities of the project area and engineering design, together with professional judgment and knowledge of past experience were used to provisionally identify the potentially most significant impacts.
3. Results of consultations with stakeholders undertaken as part of site selection were factored into the identification of the potentially most significant impacts.

To facilitate the evaluation process, the Angola LNG development was subdivided into the following main elements:

- Offshore gas gathering system (construction and operation).
- Onshore construction activities.
- The operational LNG facility.
- Decommissioning (of temporary facilities).

Potential environmental, socioeconomic, and health aspects were identified by:

- Systematically breaking down the areas of operation and construction (as noted above) into logically discrete activities or processes.
- Screening these activities, by evaluating their potential to give rise to releases, emissions or interactions with the environment or socioeconomic receptors, in order to determine those with the potential to result in an environmental, socioeconomic or health impact.

The results of the screening process are presented in the following sections.

The methodology that will be utilized in the ESHIA document itself will also include a rigorous screening process that will further investigate the interactions between the Project and the biological, physical, and socioeconomic environment. All the mitigation measures to be implemented will be taken into consideration, and an assessment of the significance of the residual impacts will then be made based on a set of criteria that will be specifically adopted for the Angola LNG Project. Issues which do not fall into a Low Significance category will be taken forward in the report and discussed in greater detail. These impacts will be quantified using mathematical models or other appropriate tools where possible.

The ESHIA will consider all planned operations. Consequences of accidental events will also be assessed in terms of a combination of magnitude of impact and likelihood of occurrence.

6.2 Impact Issue Identification

The matrix in Figure 6-1 summarizes the results, identifying potential interactions of the project with the natural and human environment as shaded squares. Interactions that are considered to relate to the potentially most significant impacts are highlighted (dark squares).

The resources and receptors shown in Figure 6-1 have been selected as a result of the current state of knowledge of the environment, including the socioeconomic environment (see Section 5.0). The elements of the Angola LNG Project that are potential sources of impact indicated in Figure 6-1 are based on the current state of knowledge of Project Design (see Section 2.0).

It should be emphasized that the results summarized in Figure 6-1 are based on the current state of knowledge and on the Stakeholder Consultations that have been carried out to date. These consultations have been related to the Site Selection Process (see Final Site Selection Report, ERM 2004) and have not been specifically directed towards the actual selected site. It is intended that through the disclosure of this report and the associated non-technical Summary documents stakeholders will be given further opportunities to express their opinions and

priorities for the Project specifically in relation to the site that has been finally selected (See Figures 2-2 and 2-3).

All potential interactions will be studied further as the ESHIA progresses. However, the majority of the effort will be focused on those impacts that are potentially most significant. This includes both potential negative impacts and potential benefits of the Angola LNG Project.

Table 6.1 describes in more detail the key potential environmental, socioeconomic and health impacts that have been identified in the ESHIA process so far as indicated in Figure 6-1. The table includes an indication of the level of stakeholder interest or concern in each of the impact areas as expressed during the site selection consultation meetings carried out to date and, where relevant, stakeholder views are described. All issues that were of high interest to stakeholders are included in the table even if the selected site is thought unlikely to pose potentially significant issues in this area.

The table also provides a description of how the Angola LNG Project intends to take forward these issues through the project development and ESHIA process in order to minimize negative impacts of the Angola LNG Project and optimize potential benefits. It is anticipated that much of the ongoing stakeholder consultation during the ESHIA will be centered on these key issues. However it is important to ensure that other stakeholder issues that arise during the ESHIA process, including scoping consultations, are taken forward for further consideration.

6.3 Indirect & Cumulative Impacts

The potential for future economic development to be facilitated by the Angola LNG Project and proximity to the source of gas for the plant was a significant factor in selecting Soyo as the general location for the development (see Section 2.0). The Angola LNG Project is likely to contribute to potentially significant cumulative impacts given its expected role as a catalyst for such development. These cumulative impacts may potentially be significantly greater than some of the direct impacts described above, particularly, habitat loss, land use, job opportunities, economic development, in-migration and cultural change and health impacts. Depending on the size of any future industrial development and in-migration rates, the size of these impacts may be large enough to change Soyo, over time, from a small largely subsistence based economy to an urban industrial area.

Figure 6-1: Potential interactions of the Angola LNG Project with the natural and human environment

	Biophysical Resources and Receptors										Socio-economic Resources and Receptors										
	erosion etc (soils, hydrology, biology & ecology)	soils and groundwater	water quality	hydrology	mineral resources	water supply	tree resources (aggregates etc)	air quality / dust	fisheries / shellfish	visual	land based (subsistence and commercial)	land based (recreation and amenity)	job opportunities and economic development	land use and (land) development	cultural heritage/archaeology	recreation and economic development	navigation	transport and services provision	immigration and cultural change	community health	community disturbance and safety
Offshore Gathering system																					
trenching																					
vessel movements and exclusion zones																					
underwater noise generation																					
vessel discharges and emissions																					
Onshore Construction Phase																					
dredging																					
reclamation																					
earthworks (piling, excavation, grading etc)																					
spoil disposal																					
vessel movements and exclusion zones																					
landtake																					
land clearance (UXO & vegetation)																					
land drainage																					
construction wastes																					
plant etc emissions																					
traffic generation (land and water)																					
onsite plant movement																					
fabrication & installation																					
light, noise and vibration																					
materials supply/usage																					
employment																					
influx of workers																					
construction camp etc																					
materials usage																					
materials storage																					
Provision of goods, materials and services																					
access infrastructure (construction roads etc)																					
Onshore Operational Phase																					
gas treatment																					
cryogenic process																					
export infrastructure (flowlines, cryolines)																					
LNG storage																					
vessel movements and exclusion zones																					
maintenance dredging																					
gas turbines																					
flaring																					
infrastructure (transport and services)																					
employment																					
goods, materials & services																					
light, noise and vibration																					
drainage																					
sewage and grey water																					
fluidised sulphur treatment																					
solid waste management																					
workforce facilities (accommodation etc)																					
Decommissioning and Reinstatement																					
earthworks (profiling etc)																					
demolition works																					
cleanup																					
waste disposal																					
landscaping																					
aftercare & monitoring																					
employment																					

Note: The darker the grey the greater the impact or interaction.

The site selection exercise for the Soyo alternatives demonstrated that certain types of development, above and beyond Angola LNG, are possible in the Soyo area. The Best Shipping site was recommended in part on the assumption that the Angola LNG Project fully explores all opportunities to promote secondary development and economic growth in the Soyo area. In recognition of Angola's aspiration for further development, the Angola LNG Project has committed to work with national and local government agencies to study the types of industry that might usefully benefit from or have other synergies with Angola LNG. The study will also consider issues that may have an influence on the nature of cumulative impacts such as the most appropriate location for such industry and the infrastructure that is required.

In accordance with this effort, Angola LNG will sponsor and participate in the Sonongal led industrial development study of the Soyo region. Angola LNG will also participate with Sonongal and the Angolan Government in a Strategic Environmental, Social, and Health Assessment that will examine the cumulative benefits and impacts of the resulting potential development scenarios. Potential mitigation measures for these scenarios will be identified and if appropriate incorporated into the ESHIA. This will enable the wider planning effort to capture synergies with the Angola LNG planning, ESHIA, and industrial development plan.

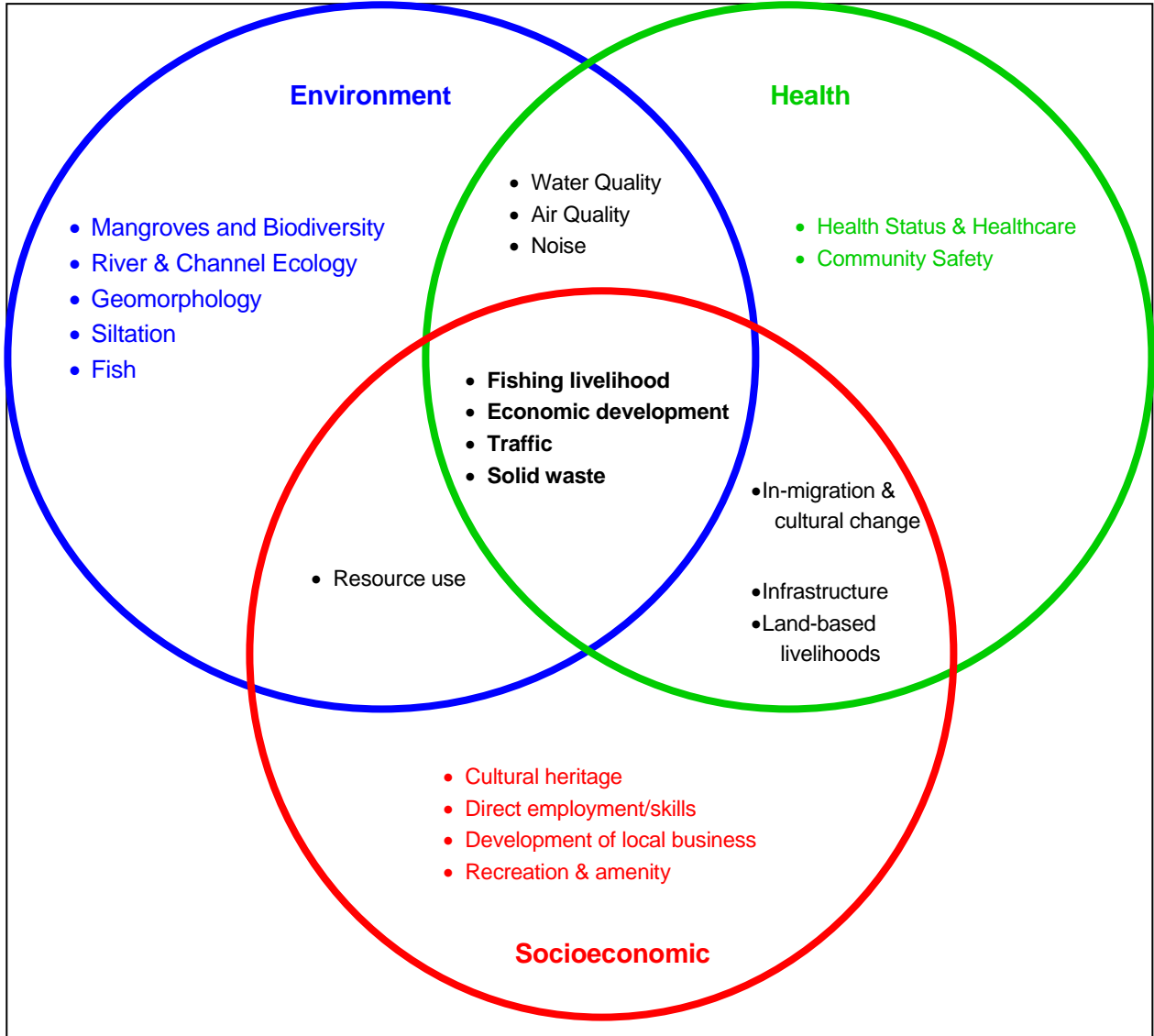
Indirect impacts, such as those that may be associated with in-migration to the region being stimulated by the Angola LNG Project will be, to the extent possible, addressed in the ESHIA process.

6.4 Cross Cutting Issues

Many of the potential impacts of the Angola LNG Project cut across disciplines, either intrinsically or in terms of secondary impacts (for example emissions have a primary effect on the atmospheric environment, with potential secondary effects on human health). These possible interrelationships and interactions are summarized below in Figure 6-2.

The advantage of the integrated ESHIA approach is that such impacts will be fully assessed by considering the environmental, socioeconomic, and health elements and how they interact for each issue. Similarly, mitigation measures will be developed with full consideration of relevant environmental, socioeconomic, and health interactions. Consultation with stakeholders will cover all issues of interest to the stakeholder whether this is environmental, socioeconomic, or health in nature.

Figure 6-2: Cross-Cutting Issues



6.5 Conclusions of the Scoping Assessment

This Scoping document represents the first step in the ESHIA process that will be undertaken by Angola LNG. It builds on a number of existing studies, most notably: Environmental and Socioeconomic Considerations for the Siting of the Angola LNG, (ERM, May 2004) a report that will be available upon request.

The Scoping document describes the proposed Terms of Reference for the ESHIA through the overview of:

- The ESHIA philosophy and schedule and scope of the ESHIA process
- The screening of environmental, health, and socioeconomic affects and benefits and identification of the key affects and benefits
- The proposed strategies to address the key affects and benefits
- The gaps in available baseline data identified
- The proposed strategies to fill these gaps

Stakeholder consultation has been identified as an essential element of the ESHIA process and will continue from the scoping phase throughout Project development. This process will ensure that Angola LNG will take into account all the issues that are of significance to Project stakeholders and that the opinions of stakeholders are sought on key issues.

The fishing community is a key stakeholder group that will be consulted throughout the ESHIA process



It is considered essential to adopt a direct consultation and informed participation approach to the development of mitigation measures for vulnerable social groups on key issues such as those associated with indigenous people's rights and with involuntary resettlement and compensation. Further, it is considered important to seek consensus on decisions relating to the need or otherwise for the incorporation of specific mitigation measures such as Indigenous Peoples and Resettlement Action Plans in the ESHIA process. It is anticipated that initial discussions on such key issues will be held with the relevant stakeholders during the scoping consultations.

It is finally important to note that the Angola LNG Project will have benefits that will extend from the local economy and into the national and regional economies. These benefits will be explored fully as the ESHIA process progresses and will be documented in the final ESHIA report.

A Conceptual Plan for Coordinated Industrial Development for the Soyo Municipality is being developed independent of the Angola LNG Project. When this plan is finalized, the Project will review such to determine whether there are synergies that could be captured that will benefit all parties. Any such synergies that could impact the Project will be assessed in the ESHIA process. The conceptual plan will likely have implications beyond the direct scope or control of the Project.

Table 6.1: Impacts Identified and their Management

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
Biodiversity & Ecology	<p>Preliminary Stakeholder Interest Identified: Moderate</p> <p>General Description</p> <p>The Angola LNG Project location area has a number of potential biodiversity sensitivities. Probably the most important of these is the presence of mangrove communities. These are of high biodiversity and ecological value, as they are crucial in the overall ecological functioning of the region. The mangroves may also harbor rare or endangered animals such as manatees, though this requires further clarification. Damage to mangroves can result in significant secondary impacts including loss of fishery resource, increased erosion and loss of forest resources (food, fuel etc). There are also several important protected/endangered species in the Angola LNG Project area. The offshore marine environment harbors significant populations of cetaceans, including breeding humpback whales. Marine turtles also nest on the beaches of the area. Installation of the offshore gathering system and construction of the main pipeline landfall could potentially have significant impacts. The timing and design of these works will thus need to accommodate these sensitivities.</p> <p>Potential Significant Impacts</p> <p>The land take and dredging anticipated for the Best Shipping option is not predicted to have a significant direct impact on mangroves, it is thought that only 1.3% of the total mangrove area would be impacted. However there is a moderate probability that secondary impacts would convert an estimated 6% of mangrove habitat to sediment. Turbidity caused by the dredging activity may adversely affect sea grass habitat but this impact can be managed and probability of significant effects to sea grass would be low. Impacts on manatee and their habitats are not likely to cause unacceptable negative impacts to the population in the Congo River due to the transient nature of manatee use of the project area and the magnitude of the impacts on other biological resources on which they depend. In summary the best shipping site will have some effects on mangroves and physical chemical processes but would not be of sufficient magnitude to affect the integrity of the ecosystem. Significant Conversion or Degradation are not predicted as the proportion of habitats affected is small and magnitude of change in physical parameters also small.</p> <p>Stakeholder Issues:</p> <p>Although environmental awareness at the community level is currently low, mangroves are recognized by local communities (particularly fishermen) as being important to fisheries.</p>	<p>The site chosen for the Angola LNG Project has been selected in part because it minimizes direct impact on mangroves. It also minimizes dredging and landtake.</p> <p>Careful design will be critical in mitigating these impacts. An important component of this is appropriate phasing of the offshore works to avoid turtle nesting, whale calving or fish spawning seasons/areas as far as possible, together with other operational safeguards.</p> <p>A clearer understanding of the precise ecological issues will be achieved with better knowledge of the receptors. Specifically, further investigation will be required to understand the extent of mangrove biodiversity (especially West African manatees) and to clarify the status of such species as manatees in the area.</p> <p>Further investigation will also be needed to quantify the importance of the offshore area to cetaceans and turtles.</p>

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
Erosion/Siltation	<p>Preliminary Stakeholder Interest Identified: Moderate</p> <p>General Description</p> <p>Both offshore and onshore components of the Angola LNG Project have potential for erosion impacts. Nearshore pipelines may require burial, in which case trenching may lead to geomorphological effects. The onshore component has a greater potential for impact, as it will involve significant disturbance to the foreshore during landfall construction, as well as a significant degree of dredging for the marine export facilities. Onshore construction may also require additional mitigation, which may affect riverbank morphology. Given the sedimentary nature of the Pululu channel system, this may result in deposition rather than erosion. Nonetheless, the result may be a change in local water flow as well as secondary habitat impacts. Maintenance dredging will also be required for the operational facility.</p> <p>Potential Significant Impacts</p> <p>The best shipping option will result in the following direct impacts on the seabed -</p> <p>486 ha of channel dredged for channel and reclamation and 0.1% of Pululu Channel dredged.</p> <p>The area of seabed which would need to be reclaimed north of the existing shoreline may have impacts on the coastal geomorphology of the area but the existing low energy, sheltered nature and hence low sensitivity of the site suggests that any change in current flow would be small and localized, although this would require further work to evaluate the potential effects in detail sufficient to optimize design.</p> <p>Hydrodynamic modeling indicates that the best shipping option causes a reduction in the order of 0.2 m at low water and 0.1 m at high water. The average reduction at high water is not considered significant as the width of effect will be small due to the relatively steep profile of the mud at the edge of the mangroves. The reduction at low water is likely to have little effect overall since the areas of exposed intertidal mud at low water at the edge of the mangrove are relatively small. The best shipping option will cause a reduction in tidal velocities and sediment deposition in the outer channel. This could effectively make the channel a silt trap at this point moving the area of most significant deposition north from its current location opposite Kwanda Base.</p> <p>Stakeholder Issues</p> <p>Based on the results of the consultations, stakeholders are not predicted to have major objections to the dredging impacts unless habitats and species are affected. However the Soyo Administration expressed particular concern in avoiding erosion impacts at sites that are used to provide fill materials for leveling the site and reclaiming the additional land.</p>	<p>Further work will be required to optimize design in order to minimize any potential impacts on coastal processes and features.</p> <p>Studies are ongoing.</p> <p>The effects of wake could be mitigated by management of vessel operations (i.e. speed) and if necessary the construction of a wave barrier.</p>

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
Water Quality	<p>Preliminary Stakeholder Interest Identified: <i>Low</i></p> <p>General Description</p> <p>Impacts on water quality may result from both construction and operational activities. This is potentially significant as it could impact the water resource of local people.</p> <p>Potential Significant Impacts</p> <p>Both construction and maintenance dredging can have the following direct effects on water quality:</p> <p>Increase in suspended solids; decrease in oxygen concentration; increase in nutrient levels; and release of sediment bound contamination.</p> <p>The selected Best Shipping option will result in the following impacts:</p> <p>Fine material from dredging is likely to remain in suspension for more than one tidal cycle, the plume of contaminated water is predicted to extend down current and would be carried into the Pululu Channel on the flood tide.</p> <p>The concentration of discharged effluent (e.g. suspended solids load) released during construction and operation is predicted to be measurably above background levels, but due to increased dispersion would recover within one tidal cycle.</p> <p>Natural water quality is likely to occur within one or two tidal cycles once the dredging has stopped.</p> <p>Locating the LNG project facilities at the Best Shipping site is not expected to cause a decrease in suspended sediment south of Kwanda Base. Likewise, there should be no negative impacts on water quality in this area due to this siting.</p> <p>Stakeholder Issues</p> <p>Based on the results of the consultations, stakeholders are not predicted to have major objections to the dredging impacts unless habitats and species are affected.</p>	<p>Discharge regimes (i.e. treatment level and location of discharges) will need to be designed carefully to ensure that water resources are not adversely impacted. The precise pattern and sources of drinking/washing water for communities around the site will need to be established as part of this process.</p> <p>It is expected that ship de-ballasting will not be a major issue here as it will be a project requirement for all LNG tankers to follow SITTGO and IMO guidelines concerning such. This should prevent the introduction of any foreign species to this area. The impacts of any sanitary, cooling water, or process wastewater discharges will be managed through the FEED process and will require alignment with Angolan, World Bank, and other applicable international standards.</p> <p>Wastewater will be discharged subject to detailed impact analysis and acceptable levels of potential impact.</p>
Hydrology	Impact of reclamation	To be addressed in dredging/reclamation ESHIA
Water Supply	See Water Quality above	
Mineral resources	No predicted significant impacts	
Forest Resources	No predicted significant impacts	

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
Air Quality/Dust	<p>Preliminary Stakeholder Interest Identified: High</p> <p>General Description</p> <p>One of the core components of the Angola LNG Project concept is to eliminate flaring of gas in Angola. The construction and operation of the Angola LNG Project will result in air emissions.</p> <p>Potential Significant Impacts</p> <p>With the elimination of flaring the Angola LNG Project can be seen as a net benefit in terms of Greenhouse Gas Emissions. Onshore emissions may result in local deterioration in air quality.</p> <p>Stakeholder Issues</p> <p>Many local stakeholders noted concern regarding the apparent reduction of certain crop yields and changes in crop seasons in the local area. These changes are perceived as the impact of the ongoing flaring of gas. In this respect, the Angola LNG Project was welcomed, as it is believed that this will stop such impacts</p>	<p>Project design will be carefully assessed to ensure that air quality parameters in the vicinity of the plant are maintained within the concentration limits designed to protect human health and the environment.</p>
Visual Impacts	No predicted significant impacts	

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
Fish stocks/ Fisheries	<p>Preliminary Stakeholder Interest Identified: High</p> <p>General Description</p> <p>Dredging activities during construction and maintenance will cause disturbance and a reduction in water quality that may impact fish and fishing activity.</p> <p>Potential Significant Impacts</p> <p>Impacts are likely to be temporary with fish levels re-establishing after cessation of dredging activities</p> <p>Stakeholder Issues</p> <p>The Pululu Channel and associated channels are secondary locations to sea fishing for fishermen. However it is the primary area for local households who fish as one of a number of sources of income. Early consultation meetings indicate that this is approximately 5-10% of local households.</p> <p>The Angola LNG Project's impact on fishing livelihoods will include impacts on fish populations themselves and loss of access to either fishing grounds, fishing villages or markets (due to the establishment of a marine exclusion zone and increased vessel traffic).</p> <p>Both of these may cause a decrease in subsistence food sources for local families and/or reduced cash income from selling fish/seafood products at both local markets and those further afield in DRC. There is also the potential for some knock-on impact on those who depend indirectly on local fishing activities (e.g. boat and net repairers, fish distributors etc).</p> <p>Dredging for the best shipping option will only have a limited (0.2%) on the Pululu Channel therefore fisheries in the mangrove channels should not be significantly impacted.</p>	<p>Potential fisheries impacts will be evaluated through a combination of modeling and livelihoods analysis with local fishermen. Should significant impacts be predicted, the Angola LNG Project will consider measures to reduce the impacts, and if necessary, work with those affected to identify appropriate compensation measures. Should significant livelihoods impacts be predicted, compensation will follow the guidelines for economic resettlement as established by the World Bank (see Table 2.2 and Sections 3.3 and 5.4.1 above).</p>

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
Land-based Livelihoods	<p>Preliminary Stakeholder Interest Identified: High</p> <p>General Description</p> <p>The area of approximately 4 km² required for construction of the LNG facility is mainly located on land within the existing fence line of Kwanda Base, or on land that will be reclaimed. The land that will be used outside the fence-line is mainly swampy and is not believed to be used for economic activities. Eight small shacks and gardens, part of the community of Bumba Luka, border the fence line for the LNG plant and laydown area.</p> <p>Potential Significant Impacts</p> <p>At present no land-based livelihood impacts are expected.</p> <p>Stakeholder Issues</p> <p>High stakeholder interest recorded is mainly related to the other sites evaluated for the LNG plant and is not related specifically to the selected site.</p>	<p>Confirmation of predicted low impacts will be tested and evaluated in further stakeholder consultations and evaluations in the ESHIA process.</p>
Cultural Heritage	<p>Preliminary Stakeholder Interest Identified: High</p> <p><i>Stakeholder Issues</i></p> <p>Stakeholder concern was high in connection with other sites evaluated but development of the selected site is not expected to have any direct impact on cultural heritage.</p> <p>Other sites considered by the Angola LNG Project would have affected or been close to cultural sites and this was an area of high concern for local and government stakeholders.</p>	<p>Although no impacts on cultural heritage are anticipated, confirmation will be made through the continuing ESHIA process.</p> <p>The information collected during the site selection data gathering and consultation may be useful in the review of appropriate locations for secondary industry (see Job Opportunities and Economic Development below).</p>

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
Land Use and Future Development	<p>Preliminary Stakeholder Interest Identified: High</p> <p><i>General Description</i></p> <p>The construction of the LNG site will include the reclamation of some 90 hectares of land. After the operational life of the LNG facilities, this land will be decommissioned and made suitable for other uses as agreed with the government.</p> <p>The Angolan Government views Soyo as a centre for future development and Angola LNG as being a catalyst for this development.</p> <p><i>Stakeholder Issues</i></p> <p>Kwanda island with its proximity to the existing commercial port is prime land for development. During consultation many consultees expressed preference for sites away from Kwanda Base hoping that the LNG facility could catalyze another area of land for development.</p>	<p>The Angola LNG Project team has selected the Kwanda Base (Best Shipping) site due to its many advantages, particularly with regards to shipping access. However, in recognition of the great aspiration for further development in the Soyo area, the Angola LNG Project has committed to work with government agencies to study the types of industry that might usefully benefit or have other synergies with Angola LNG (see Section 6.3 below).</p> <p>The ESHIA for Angola LNG is being undertaken in the absence of a strategic development plan for the Soyo area. Given this context, the Angola LNG Project has as part of its site selection, and will continue, to aim to avoid any conflicts with future land uses. This will be undertaken through broad consultation with government agencies and other relevant organizations in Luanda and Soyo.</p> <p>As an example of this commitment, the Angola LNG Project team will also work to ensure that the design and operation of the plant does not impede existing and future uses of the commercial port and Kwanda Base jetties and where appropriate contributes to the ongoing development of port operations.</p>

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
<p>Job Opportunities and Economic Development</p>	<p>Preliminary Stakeholder Interest Identified: High</p> <p><i>Potential Significant Impacts</i></p> <p>Angola LNG Project employment will be concentrated during the construction phase of the Project and will positively benefit those within the community who receive jobs. In general terms, the cash income provided by employment will allow those employed to access a wider number of goods and services. This will improve the general quality of life and sense of well-being of those employed and those that they support. The cash injection to local businesses caused by local employment will also have a positive knock on effect, increasing indirect employment by helping local businesses and support services to grow. An increased workforce and Project needs are also likely to provide opportunities for local business development.</p> <p>The economic stimulus is likely to result in localized inflation in the cost of goods such as food and housing, resulting in reduced purchasing power of people not employed or otherwise benefiting from the Angola LNG Project.</p> <p>The magnitude of these impacts cannot yet be estimated, but will be far greater during the period of construction than operation. It is also unlikely that there will be sufficient opportunities to meet very high local expectations, and this will lead to intense competition between applicants for any positions. In addition, most local residents will not be sufficiently skilled to take up the positions that are available, potentially leading to local frustration and resentment.</p> <p>Employment will provide opportunities for skills transfer and local capacity building providing a better trained body of personnel in the Soyo area.</p> <p>At the national level, the Angola LNG Project is not expected to provide any government revenues over the short term.</p> <p><i>Stakeholder Issues</i></p> <p>The need for jobs and opportunities for the population of Soyo, especially for young people, was a key expectation raised throughout both rounds of consultation during site selection.</p>	<p>Angola LNG is committed to maximizing the use of appropriately qualified local workers and an Employee Needs Assessment and Training Plan will be carried out as part of the ESHIA. This will identify the employment needs of the Angola LNG Project and the ability for these needs to be filled on a local, regional and national level. The Angola LNG Project will prioritize local people for employment where they have the required skills and experience. Any measures developed to promote local employment will be accompanied by extensive consultation and communication to manage expectations.</p> <p>A Macro-Economic Study will be carried out as part of the ESHIA. This will consider the potential positive and negative impacts that could result from the Angola LNG Project including inflationary effects. The Macro-Economic study will inform stakeholders of the scale and nature of the economic impacts and will guide the Angola LNG Project as to the types of supporting actions that can ensure maximum national, regional and local benefits.</p>

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
<p>Recreation and Amenity</p>	<p>Preliminary Stakeholder Interest Identified: Moderate</p> <p><i>General Description</i></p> <p>Praia dos Pobres (Beach of the Poor), located on the northern side of Kwanda island is used by local people close to Soyo town, particularly those who do not have transport to reach the better quality beaches along the Atlantic shoreline. Solid waste is not currently being collected in Soyo and is a significant blight as well as a potential health hazard to those using water bodies including the Congo River for swimming and bathing.</p> <p><i>Potential Significant Impacts</i></p> <p>Access to the beach itself will not be affected, however the LNG facility will be clearly visible from the beach and there may be some noise and other disturbances, particularly during construction</p> <p>Construction and operation of the Angola LNG Project will generate large volumes of waste materials, some of which will be hazardous to people and the environment. Responsible management of solid waste will ensure that impacts on the environment and people can be minimized.</p> <p><i>Stakeholder Issues</i></p> <p>The Soyo Administration expressed particular concern regarding the disposal of waste material from dredging.</p>	<p>Noise, odor and visual impacts will be assessed in detail as part of the impact assessment and appropriate</p> <p>Mitigation measures will be adopted by the Angola LNG Project.</p> <p>The</p> <p>Angola LNG Project has committed to keeping operational noise impacts within international as well as national standards.</p> <p>Access to the beach will be maintained.</p> <p>The Angola LNG Project will discuss potential strategies for waste management with the local authorities to see if there are any synergies with plans for local waste disposal.</p> <p>Impacts to the environment and people due to waste management are largely manageable and preventable. The Angola LNG Project will develop a Waste Management Plan that will take into consideration such matters as avoiding waste generation in the first place, recycling and reuse. Where disposal will be required the Angola LNG Project will develop, possibly in collaboration with others, suitable facilities for storage, treatment and safe disposal.</p> <p>A suitable location for disposal of dredged material will be specifically studied to identify a site that does not cause negative environmental impacts.</p>
<p>Navigation</p>	<p>Preliminary Stakeholder Interest Identified: Low</p> <p><i>General Description</i></p> <p>During construction there will be high boat traffic bringing in construction equipment and materials to an infrastructure/construction dock. There will also be reclamation and dredging activities. These activities will need to be scheduled with existing commercial boat movements.</p> <p><i>Potential Significant Impacts</i></p> <p>During operation of the LNG plant, movement of LNG ships (approximately four boat movements per week) will restrict or stop movement of shipping into and out of the commercial port and Kwanda Base jetties. However, movement in the Congo river should not be affected.</p> <p>The wake of the boat movements during construction and operation will also increase the existing hazard to smaller boats used by local fishermen to travel between Soyo, their fishing villages and fishing areas.</p>	<p>A specialist team within Angola LNG is liaising with the Soyo Port Captain and will work to ensure that shipping safety standards are maintained whilst preventing significant impact on commercial boat movements. This will be assessed and reported on in the ESHIA.</p> <p>Land reclamation will not impinge on the commercial shipping lane.</p> <p>The ESHIA will consider impacts on the movement and safety of smaller boat traffic. Measures to reduce risks and impacts on livelihoods will be agreed with the Angola LNG Project and those affected and reported on in the ESHIA.</p>

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
Housing	<p>Preliminary Stakeholder Interest Identified: Moderate</p> <p><i>General Description</i></p> <p>During construction, the majority of the workforce will be housed in a temporary construction camp. This will reduce the demands of the Angola LNG Project on the current housing stock. However, there will be secondary and indirect pressures on the housing stock due to the increased purchasing power of local employees and in-migration.</p> <p>Plans exist to build new houses in the Soyo area, both within and outside of Kwanda Base. Those concerned (Soyo administration, Sonangol, Kwanda Base) note that they will review these plans now that the site for Angola LNG has been selected.</p> <p><i>Stakeholder Issues</i></p> <p>Local consultees are keen to see the Angola LNG Project integrate into the local community as much as possible, through for example housing some employees (e.g. management) within the town rather than in separate camps.</p> <p>Some international consultees based in Luanda emphasized the need for the Angola LNG Project to consider housing and look at ways to catalyze the construction of new houses.</p>	<p>Although the majority of non-local construction workers will be housed in a construction camp, the Angola LNG Project will consider different models for other workforce housing. This will take into account a range of factors and involve communication with the local authorities and other stakeholders and will also need to take into account in-planned in-migration.</p>
Transport and Services Infrastructure	<p>Preliminary Stakeholder Interest Identified: High</p> <p><i>General Description</i></p> <p>The Angola LNG Project will bring in the majority of the large equipment and materials by ship. However, the airport (which may be relocated), will be used to bring in personnel and some smaller equipment and may need to be improved. The road linking the airport to the Angola LNG Project site, which passes through the centre of Soyo town, will be used and similarly may need to be improved. Other personnel transport requirements are likely to be limited by locating accommodation near the Angola LNG Project site.</p> <p>The Angola LNG Project will develop its own energy and water provision and will provide its own health services. It is not yet known whether some workers will bring their families and therefore require education services.</p> <p><i>Stakeholder Issues</i></p> <p>Local communities consulted expressed high expectations that the Angola LNG Project will provide increased access to energy, particularly gas for cooking. Residents in the Soyo area are fuel poor, and in particular do not have enough energy to meet cooking needs. With increased in-migration the pressure on existing fuel supplies including wood from sources in the dry grassland/forest area and from the mangrove area is likely to increase.</p>	<p>Impacts on transport and service infrastructure will be considered within the ESHIA.</p> <p>The presence of LPG's is well established in the gas streams, recovery is being designed and Liquid LPG will be available.</p>

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
<p>Immigration and Cultural Change</p>	<p>Preliminary Stakeholder Interest Identified: Moderate</p> <p><i>General Description</i></p> <p>The structure of communities neighboring Angola LNG Project facilities will be most subject to pressures on traditional cultural patterns (respect for elders and <i>soba</i> structure, intra-familial solidarity). These pressures may increase existing points of conflict (e.g. lack of confidence in leadership) and also accelerate any changes in traditional power balances.</p> <p>Traditional ways of life in neighboring communities may also be impacted by the influx of a largely non-local workforce, or anti-social behaviors by workers (e.g. alcohol abuse, drug use, disorderly conduct and use of commercial sex workers).</p> <p><i>Potential Significant Impacts</i></p> <p>Locating the Angola LNG Project in the Soyo area is also likely to cause (and according to anecdotal evidence has already caused) significant in-migration to the Soyo area. This will add to the continuing migration of people to the area, returning after the Civil war and fleeing conflict in neighboring countries. As demonstrated in Luanda, which has experienced massive in-migration, people are drawn to potential employment and business opportunities. Any increase in the local population will place pressure on existing infrastructure and resources, compounding the following issues/impacts:</p> <ul style="list-style-type: none"> • Unaffordable rents for local tenants due to increased demand for housing. • Pressure on existing land and natural resources used for subsistence activities (e.g. food cultivation, firewood gathering). • Further stress on traditional cultural patterns as the local Bakongo population is diluted. • Increased stress on families. <p>Special Studies (In-migration Assessment, Institutional Needs Assessment, Employment Needs and Training Plan and Participatory Needs Assessment) are being conducted or planned during 2005 to better understand and develop mitigation plans.</p>	<p>The Angola LNG Project will always seek to work with local leadership structures and act in a manner that is respectful to local customs and norms.</p> <p>The ESHIA will include additional studies on in-migration and the local culture framework to further understand:</p> <ul style="list-style-type: none"> • Current in-migration patterns to the area. • Infrastructural capacity to absorb immigrants. • The cultural make-up of Soyo area and where possible cultural features of likely in-migrants. <p>Angola LNG will only have partial influence on this impact and will need to work with other organizations both nationally and locally to develop appropriate measures to manage in-migration and its knock-on impacts. The Angola LNG Project will also develop measures to minimize negative impacts on local communities by the workforce.</p>

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
<p>Community Disturbance and Safety</p>	<p>Preliminary Stakeholder Interest Identified: Low</p> <p><i>General Description</i></p> <p>Particularly during construction, Soyo residents, particularly those in the communities located close to facilities, construction camps or roads from the airport to the construction site, will experience some disturbance impacts (e.g. noise, vibration, and dust). Increased road traffic will also be a safety hazard to local people, particularly the young. The community may also be disturbed by non-local workforce (see in-migration and cultural change above). During the operational phase these impacts will be of low intensity.</p> <p><i>Potential Significant Impacts</i></p> <p>During operation there will be an occasional need to use the flare. This will result in noise and light and could disturb nearby communities. However, the duration of any flaring will be short.</p>	<p>These impacts are largely preventable with good planning and project control. The ESHIA team will work with Angola LNG and in consultation with local authorities and affected communities to identify appropriate measures to manage and/or eliminate these impacts. This is likely to include road safety controls and features to minimize noise and visual disturbance. There is also likely to be rules and disciplinary procedures to govern worker behavior during work and after-work hours. The Angola LNG culture of an incident and injury-free (IIF) environment will be promulgated throughout the Angola LNG workforce.</p> <p>Emergency Response Plans will be developed for explosion, fire and potential releases.</p> <p>Communities will be warned about the requirement for occasional flaring.</p>
<p>Community Health</p>	<p>Preliminary Stakeholder Interest Identified: To be Verified</p> <p>Impacts are likely to include:</p> <p><i>Health Status</i></p> <p>Possible increased incidence of STDs/HIV infection resulting from increase in commercial sexual relations and in-migration from areas with higher prevalence of these diseases.</p> <p>Increased demands on water and sanitation could lead to increased solid waste and shortages of water, in turn leading to diarrhea disease. Increase in drainage water could lead to greater problems in vector control (especially malarial mosquitoes)</p> <p>Possible shifts in breeding grounds of Tsetse fly and malarial mosquito. This may increase the risk of disease and requires specialist analysis.</p> <p>Tuberculosis in the workforce (exacerbated by communal living conditions) spreading to host population.</p> <p>Nutritional changes (positive and negative) resulting from changes in household income and subsistence products and local inflationary pressures.</p> <p><i>Health Care</i></p> <p>In-migration increasing demands on primary health care services, requiring additional primary health workers and ongoing training, new health posts and increased drug supply.</p>	<p>The ESHIA will conduct a full health baseline data gathering study to ensure that all health impacts can be identified and understood and appropriate mitigation measures developed. The ESHIA includes an assessment of institutional capabilities that will include an evaluation of health provision capabilities. Groups vulnerable to changes in health status or provision will be identified and specifically considered.</p> <p>Management of health impacts is likely to include a range of measures such as health education of the workforce and community, workforce health check and treatment and minimizing direct impacts that can lead to indirect community health consequences.</p> <p>A comprehensive Health, Environment and Safety Plan will be developed. In the area of health it will specifically address importing diseases, foreign workers susceptible to local diseases, infrastructure, health education for workers and the public and other issues identified in the health impact assessment.</p>

Issue	General Description/ Potential Significant Impacts/ Stakeholder Issues	Way Forward/Mitigation Measures
	The potential increase in wealth of some local residents may lead to growth in private facilities.	
Cumulative Impacts	<p>Preliminary Stakeholder Interest Identified: To be Verified</p> <p><i>Potential Significant Impacts</i></p> <p>The Angola LNG Project is likely to cause significant cumulative impacts given its expected role as a catalyst for further economic development in the Soyo area. These cumulative impacts will be based on some of the direct impacts described above, particularly, land use, job opportunities economic development, in-migration and cultural change and health impacts. Depending on the size of any secondary industry development and in-migration rates, the size of these impacts may be large enough to change Soyo over time from a small largely subsistence based economy to an industrial city.</p>	Angola LNG will only have partial influence on these impacts and will need to work with other organizations both nationally and locally to develop appropriate measures to carefully manage the changes likely to be brought about by secondary industry development and in-migration.
Transboundary Impacts	<p>Preliminary Stakeholder Interest Identified: To be Verified</p> <p>There is the possible of environmental and socioeconomic impacts affecting receptors in the neighboring Democratic Republic of Congo (DRC)</p>	The ESHIA process will ensure that any transboundary impacts will be identified. Mechanisms for informing the DRC of these issues will be discussed between the Angola LNG Project and the Angolan Government



Appendix A

List of Documents Referenced by Angola LNG



List of Documents Referenced by Angola LNG

- Angola LNG Functional Specifications.
- Angola LNG Health, Environmental, Social, and Safety Policy, Design Philosophy.
- ERM. Angola LNG Final Selection Report. 2004
- Internal Decision Support Package Information. 2004
- DNV. Site Selection Input Environment. 2003
- ERM. Angola LNG Final Scoping Report May 2004.
- Bernier, Rene. Environmental impact of LNG Sites on the Mangroves in the Soyo Area, Angola: Preliminary Report. 2004
- Mangrove guidelines – E&P Forum and IUCN guidelines for E&P operations in mangrove areas
- Angola LNG. Operational Discharges Management Plan
- Angola LNG. Preliminary Security Assessment.
- OGP guidelines on watercraft and water in geophysical operations
- Moffat and Nichol. Channel Pululu Report. 2003
- ERM. Draft Stakeholders Consultation Plan
- ERM. Socioeconomics and Health Baseline Report. 2004
- Spe74072 – SPE paper on Integrating Social and Environmental Assessment into the Project Decision and Design Process
- Waste Management Disposal and Deposit Plan – CABGOC waste management plans for Blocks 0 and 14



Appendix B

List of Consultees

Pesnorte participants in consultation.



List of Consultees for the First Round of Consultations

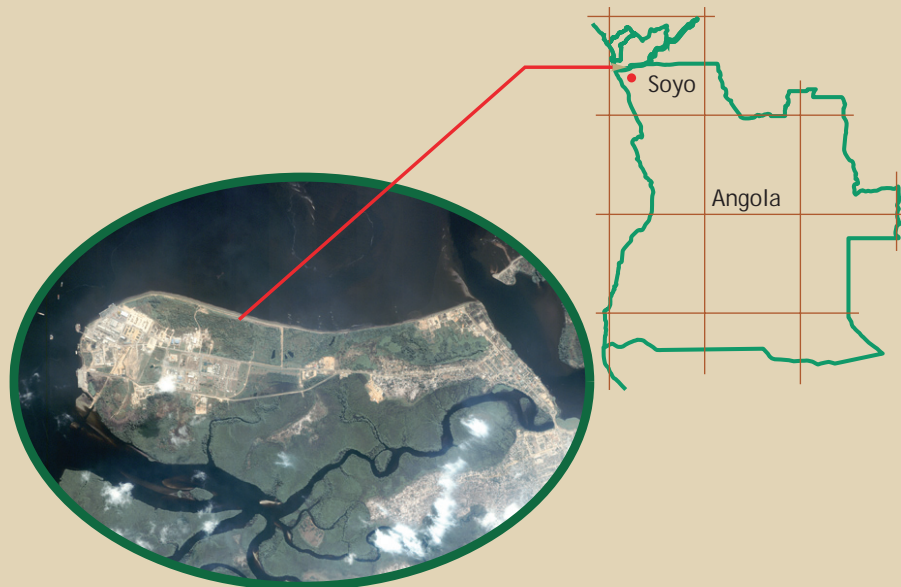
Organization	Individual
Sonangol	Antonio Orfao, Director
Sonangol	Ruben Monteiro da Costa, Chefo do Dpt. De Inssalacoes
Sonangol	Amelia Van Dúnem, Environment
Sonangol	Artur Pereira, Evaluations and Social Studies
Sonangol	Xavier Queta
Sonangol	Ruben Costa
ADPP	Else Lichtenberg, Director
Department for Women's Affairs	Palmira Virgilio
Soyo Hospital	Dr Mariano do Carmo Gaspar
Clidopa Clinic	Dr Bernado Campos
Kwanda Clinic	Gilles Dalphinnet, Medical Advisor
Soyo Administrator	Goncalo Teresa Goncalo (Assistant Administrator)
Pesnorte	Idaci Ferreira da Conceicao Director Pesnorte
Association N'Zola	Eduardo Lando Sami, President of the Association N'Zola
Port Harbour Captain, Kwanda Commercial Port	Joao Sotto
Rei do Polvo and Sobas of Soyo Municipality (Traditional Leaders)	[See Table 6.2 in this Appendix]
Teleservice Manager	Dino de Carvalho
JMC	Ema Gomes
JMC	Kiala Gabriel
JMC	Manuel Paulo
CVX Business Development Manager	Alexander Ashe
USAID	Gail Spence
Development Workshop	Carlos Figueiredo
University Geomorphology Expert	Dr Morais
Institute of Fisheries	Victoria Barros Neto, Julia Fenneiza
Ministry of Planning	Pedro Luis da Fonseca
Ministry of Urbanization and Environment	Soki Kuedikuenda
Ministry of Agriculture	Afonso Pedro Canga Jose Maria Francisco Antonio Castro Agmas
Professor of History (University)	Jose Gamboa
UNDP	Fransisco de Almeida
Juventude Ecológica de Angola	Januário Helongo Gregorio Pires
WGIR's Meeting	Rui Diogo Francisco Cruz Joao Pedro Pombal Vicente Inacio Gracasde Deus
Chevron Texaco, African Partnership Initiative	Mamadou Blondin Beye
Chevron Texaco, Government & Public Affairs	Fernando C Paiva
Chevron Texaco, Environmental Regulatory Affairs	Robert Boman Luis Anapaz
Rede Maiombe	Abias Muhongo

List of Sobas Consulted during the First Round of Consultations

Pedro Tona	Nicolau Manuel
Luis Andre Nkula Wingui	Manuel Kingalo
Rafael Dimbo	Antonio Massanga Pemba
Fernando Kutxi Keba	Eduardo Vonzo
Filipe Antonio (Ntoni Pinda)	Luis Pemba
Francisco Simba Kengue	Nascimento Bongua
Francisco Bala	Zinga Piosso
Rodrigues Konko	Joao Cai Vonzo
Carlos Kutxi	Jose Sebastiao Vemba
Alberto Dilo	Alexandre Vemba
Augusto Zombo	Jose Rodrigues
Tomas Tona	Jose Maria Nene
	Vanda Die Komba

List of Consultees for the Second Round of Consultations

Organization	Individual
Soyo Administration	Manuel Antonio, Administrator
Ministry Representatives	Palmira Virgilio (Section for Promoção de Mulher – Female Promotion - Head of Section) Paulo Suami José (MINARS, First Official Administrator) Lourenço Komba Pedro Joana (Community and Fiscal Services, Head of Section) Jerónimo Aguiar (Municipal Commerce, Head of Section)
Development Workshop	Allan Cain, Director
Sonangol	Joaquim Bundi
ADPP Escola de Professores do Futuro Zaire (Teacher Training School for Zaire Province)	Aristides Mendonca, Internal Director
Igreja Tocoista (Tocoista Church)	Jose Hilario Suzana, Secretary of Administration Augusto Mendes, Financial Secretary Alexandre D Pedro, Provincial Zaire (Zaire Province)
Carpenters	Filipe Bartolomeu, Owner of carpentry business
Igreja Evangelica de Angola-Soyo (Evangelical Church of Angola, Soyo)	Rev. Pedro Manuel, Regional Pastor
Davia-Comercio Geral (General Store)	Daniel Josefina Daniel, Manager
Comercio e Agro Pecuria (Agriculture and Fisheries Business)	Sita Joao Maria, Owner
Comercio e Hotelarias (Business and Hotels)	Francisco Arriagas, Owner
Sochio Comercio Geral (General Store)	Mario Martines Celuia
Escola de Conducao (convent)	Madalena Vieira, Administrator
Igreja Catolica do Kikudo (Catholic Church of Kikudo)	Padre Alaquais, Vigario Geral da Diocese (General Vigil of the Diocese)
Pesnorte Instituto Pesca Artesanal and Fishermen	Antonio dos Santos Junior, Director Miguel Fernando (Pesnorte) Manuel Simba (Kimpula) Afonso Simba Sieta (Kimpula) Sebastiao Casimiro (Kimbati, Woko, Fundao) Augusto A Joana (Vela Kye Soyo) Paulo Vica Formidao (Kimbazi Woko) Rodrigo Moluama Lando (Ne Mbumba Nsunda) Eduardo Antonio Ferosa (Nembumba au Sumba) Paulo José Helena (Kingangu, Kitona) Armando Zinga Simba (Kingangu, Kitona) Filipe Mouals (Becolo) Joao Songo (Becolo) Joaquim Samuel dios (Pesnorte) Jobei Ferreira (Pesnorte) Paulino Antonio (Tulumbu) André Kambua (Hoita – feca)
Rei do Povo & Advisors	Pedro Tona, Soyo Municipality, Rei de Povo Roberto S.I. Cordeiro, Soyo Municipality, Rei de Povo assistant Fernando Nkudei, Soyo Municipality, Advisor to Rei de Povo
Axi Soyo	Raul Vela Tona, Director
Low Tech Community	
Kindombe Community	
Channel Community	
Best Shipping Community	



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