



RESOURCE USE SURVEY OF THE OMATI-KIKORI DELTA

Esso Highlands Limited

PNG LNG Project

December 2008



An ExxonMobil Affiliate

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Resource Use Survey of the Omati-Kikori Delta
PNG LNG Project

1. Introduction

1.1 Project Description

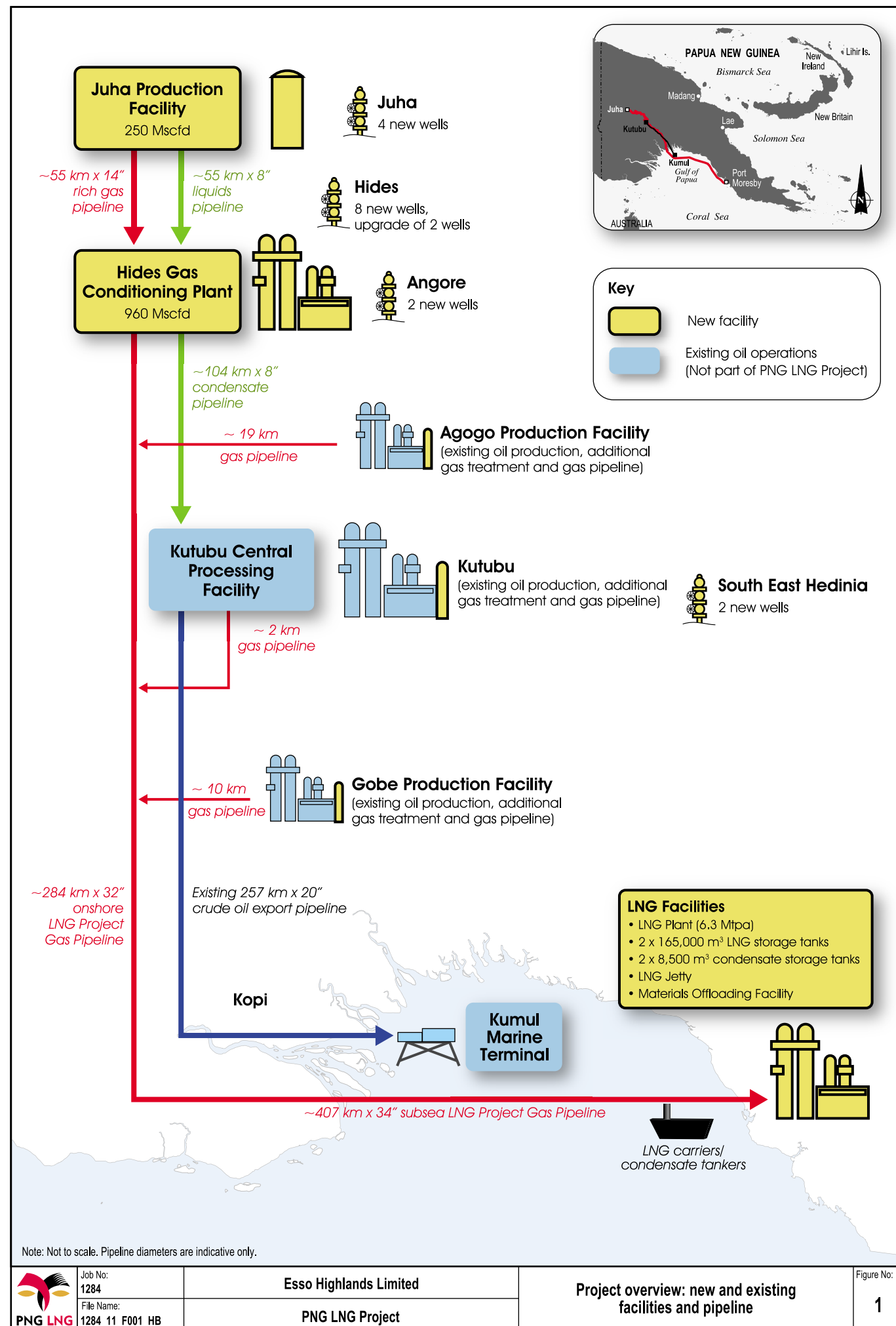
The Papua New Guinea Liquefied Natural Gas (PNG LNG) Project involves the development of a number of gas fields and facilities in a series of development phases to produce liquefied natural gas (LNG) for export. The development will also produce condensate. The development of the Hides, Angore, and Juha gas fields and blowdown of the gas caps at the existing Kutubu, Agogo and Gobe oil fields will supply the gas resources. An extensive onshore and offshore pipeline network will enable transportation of the gas to a new LNG Plant near Port Moresby and stabilised condensate to the existing oil processing and storage, and offloading facilities at the Kutubu Central Processing Facility and Kumul Marine Terminal respectively. Small amounts of condensate are also produced at the LNG Facilities site.

Esso Highlands Limited (Esso), a Papua New Guinea subsidiary of the Exxon Mobil Corporation (ExxonMobil), is the operator of the PNG LNG Project. The PNG LNG Project will be developed in five phases over a period of 10 years to ensure reliability and consistent quality of supply of LNG for over the 30 year life of the project.

A list of the proposed developments is provided below, and Figure 1 shows a schematic of facilities and pipelines:

1.1.1 Upstream Development Components

- Hides gas field development:
 - Seven wellpads with a total of eight new wells and re-completion of two existing wells.
 - Hides gathering system including gas flowlines from new and re-completed Hides wells.
 - Hides spinline and mono-ethylene glycol (MEG) Pipeline in the same right of way (ROW).
 - Hides Gas Conditioning Plant.
 - Hides–Kutubu Condensate Pipeline in the same ROW as the LNG Project Gas Pipeline.
- Juha gas field development:
 - Three new wellpads with four new wells.
 - Juha gathering system including gas flowlines from new Juha wells.
 - Juha spines and MEG Pipeline in the same ROWs.
 - Juha Production Facility.
 - Juha–Hides pipelines right of way (ROW) containing three pipelines including Juha–Hides Rich Gas Pipeline, Juha–Hides Liquids Pipeline and Hides–Juha MEG Pipeline.
- Angore gas field development:
 - Two new wellpads with two new wells.
 - Angore gathering system including gas flowlines from new Angore wells.
 - Angore spinline and Angore MEG Pipeline to Hides Gas Conditioning Plant, both in the same ROW.
- Gas from existing fields:
 - Gas treatment at the Agogo Production Facility and a new Agogo Gas Pipeline from the Agogo Production Facility to LNG Project Gas Pipeline.



- Gas treatment at the Gobe Production Facility and a new Gobe Gas Pipeline from the Gobe Production Facility to LNG Project Gas Pipeline.
- Gas treatment at the Kutubu Central Processing Facility and a new Kutubu Gas Pipeline from the Kutubu Central Processing Facility to the LNG Project Gas Pipeline.
- South East Hedinia gas field development: one new wellpad and two new wells; new gathering system including gas flow lines from the South East Hedinia new wells to the Kutubu Central Processing Facility in the same ROW as the Kutubu Gas Pipeline.
- Kopi scraper station.
- LNG Project Gas Pipeline:
 - Onshore: from Hides Gas Conditioning Plant to Omati River Landfall.
 - Offshore: Omati River Landfall to Caution Bay Landfall.

1.1.2 LNG Facilities Development Components

- Onshore LNG Plant including gas processing and liquefaction trains, storage tanks, flare system and utilities.
- Marine facilities including jetty, LNG and condensate export berths, materials offloading facility and tug moorage.

1.1.3 Supporting Facilities and Infrastructure

In addition to the principal gas production, processing and transport, and LNG production and export facilities, the project will involve the following permanent infrastructure and facilities:

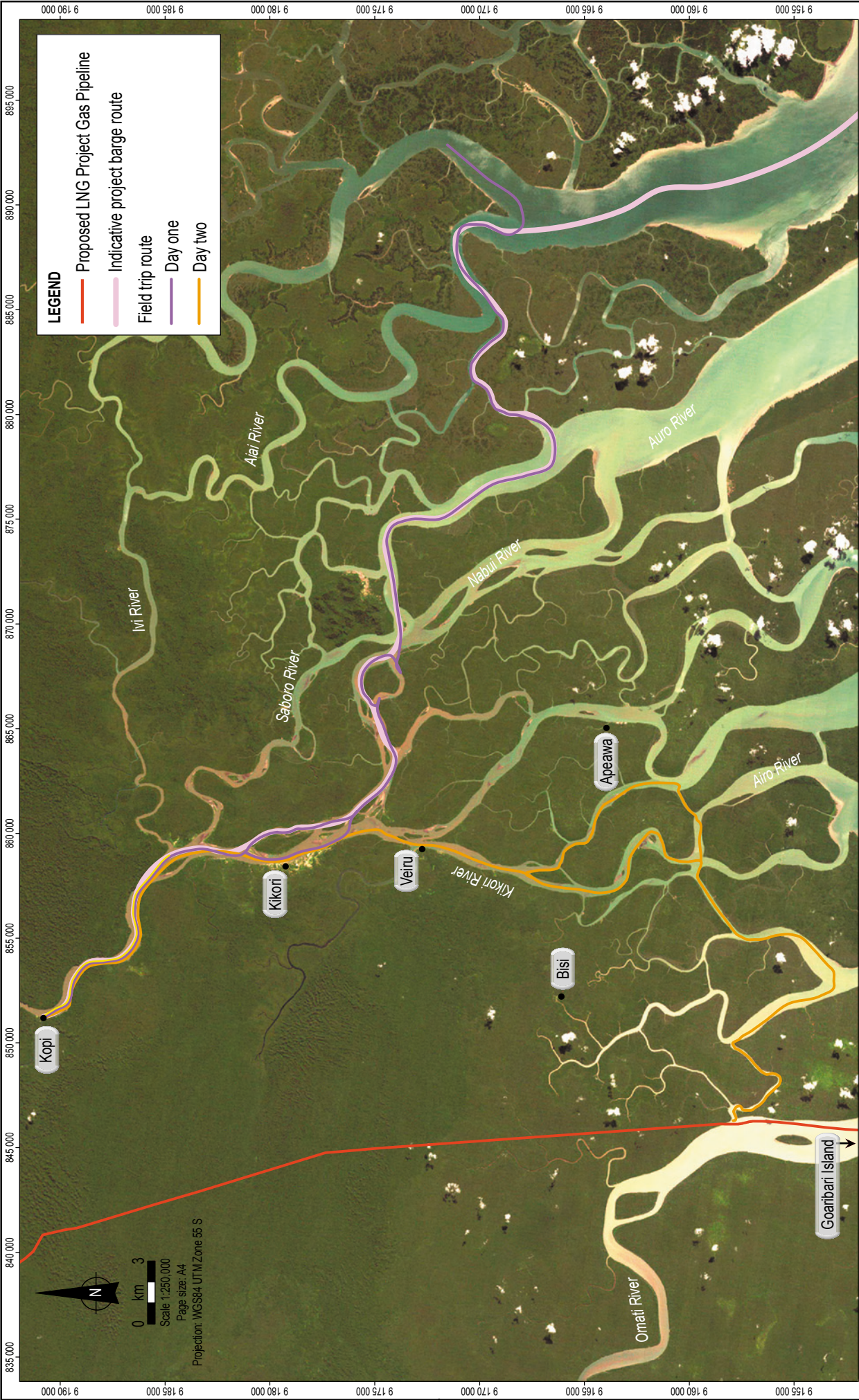
- New roads and upgrade of existing roads.
- New bridges and upgrade of existing bridges.
- Upgrade of two existing airfields (upstream at Komo and Tari).
- New helipads (multiple).
- New wharf and an upgrade of the existing Kopi roll-on, roll-off facility.
- Water supply systems and pipelines, wastewater and waste management facilities.
- Operations Camps (at Hides, Juha and Tari).

A series of temporary works and access roads will also be required during the construction phase, including:

- Construction camps (multiple).
- Material/pipe laydown areas.

1.1.4 Project Components Relevant to This Study

The geographic focus of this study is on the Omati River. Approximately 37 km of the LNG Project Gas Pipeline follows the west bank of the Omati River before entering the Omati River and continuing along the river out into the Gulf of Papua. The point where the pipeline enters the river is called the Omati River Landfall. In addition, the project proposes to transport some of the materials required for the construction of the onshore section of the pipeline upstream of the Omati River Landfall to Kopi using a barge via the Kikori River. The indicative barging project route is shown in Figure 2 and is currently used by ships delivering supplies to Kikori and Kopi.



Route travelled through the Omati-Kikori delta		Figure No: 2	
Esso Highlands Limited		PNG LNG	
PNG LNG Project		Date: 08.08.2008	
		MOU: PNG LNG Project GIS	
		File Name: 1284_11_F002_GIS_AI	

1.2 Study Objectives

In November 2007, a stakeholder consultation roadshow was conducted throughout the project area to provide information about the proposed development. The roadshow presented local people with the opportunity to gain a greater understanding of the project and also to express any concerns. The roadshow included visiting the villages near the Omati River Landfall, specifically Kopi, Kikori, Veiru, Bisi, Apeawa and Goaribari Island (see Figure 2). To reach these villages, the roadshow team travelled via dinghy along the Omati and Kikori rivers and noted a considerable amount of local fishing activity and boat traffic, comprising of canoes and small dinghies.

Information was obtained for the PNG Gas Project with respect to resource use in this area, however, given what was observed during the roadshow, a reconnaissance survey of the Omati-Kikori delta was undertaken to update existing information.

The objectives of this follow-up survey were to:

- Qualitatively determine the current status of aquatic resource use (i.e., fishing, boat traffic and transport) in the Omati-Kikori delta and the tributaries that are used for barging.
- Inform the assessment of potential impacts of the project on aquatic resource use in the Omati-Kikori delta and design of impact mitigation and management measures for the project as discussed in the PNG LNG Project Environmental Impact Assessment (EIS) Main Report.

1.3 Report Structure

This report comprises five sections:

- Section 1 (this section) – introduction.
- Section 2 – method and sources of information.
- Section 3 – summary of findings.
- Section 4 – potential issues.
- Section 5 – recommended management and mitigation measures.

2. Method and Sources of Information

Coffey Natural Systems consultants travelled to Kopi Camp for the purpose of undertaking the resource use survey of the Omati-Kikori delta. A map of the route travelled through the Omati-Kikori delta is provided in Figure 1 and the activities carried out each day during the survey are provided below.

- Day One (27 April 2008):
 - Held discussions with Delta Kikori Store retailers about operations at the Delta Kikori Store.
 - Travelled via dinghy from Kikori along the barging route currently used to bring supplies to Kikori and Kopi (see Figure 2) (i.e., the indicative project barging route) that the project is and observed levels of fishing activity and fishing methods.
 - Held discussions with Oil Search Limited's Village Liaison Officers (VLOs) about fishing methods used and species caught by local villagers, and the formation of sandbanks in the rivers.

- Day Two (28 April 2008):
 - Travelled via dinghy from Kopi Camp down the to the location of the proposed Omati River Landfall¹ (see Figure 2), visiting two fishing camps along the way for discussions with local fishermen and women.
 - Visited a market in the Kikori township selling seafood.
 - Held further discussions with Oil Search Limited's VLOs about fishing methods used and species caught by local villagers.

3. Summary of Findings

A summary of the findings is presented below, while field notes and photos from the field survey are provided in Annex A.

3.1 Resource Use

The primary fishing methods used in the Omati-Kikori delta are set gill nets, hand lines, cast nets and spears. The species caught include barramundi, threadfin salmon, catfish, black bass, bream, nursery fish, pony fish, prawn (including the giant river prawn), mudcrab and crocodile. Fishing activities are undertaken using dinghies with outboard motors and canoes with paddles and/or outboard motors. These vessels are also used for transportation.

Fishing is a subsistence activity and essential as a source of daily food for the people of the area. While surplus catch is sold to markets and logging camps, this is opportunistic and fishing as a commercial-scale activity (i.e., for selling to fish plants) has declined, with fishermen and women seeking other sources of income.

Fishing in the barging route that was surveyed appears limited. The main channels of the large rivers (including those used by barges) are not suitable for the fishing. Most nets and lines are set at eddies along the banks, where they are tied to trees or to poles pushed into the bed for that purpose, and at confluence with smaller tributaries, and within the smaller creeks.

3.2 Other Observations

It is the perception of the local people that the hydrology of the Kikori River is changing (i.e., sandbanks are forming and banks are eroding) and the first appearance of sandbanks in the river were noticed some time after the construction of the Kutubu Petroleum Development Project crude oil export pipeline and/or commencement of logging activities in the area. Hence the local people feel that the increased levels of sedimentation are associated with these activities. The presence of sandbanks upstream of the pipeline (see Annex A, Plate A8) suggests that at least some of the sedimentation effects are not related to pipelaying.

¹ Since the completion of the fieldwork component of this study, the proposed location of the Omati River Landfall was moved approximately 400 m upstream.

4. Potential Issues

Potential issues associated with the project relevant to resource use in the Omati-Kikori delta are described below. A pre-mitigation impact assessment of these issues is provided in the report titled *Offshore Impact Assessment*, which is an appendix to the PNG LNG Project Environmental Impact EIS. A post-mitigation impact assessment of these issues is provided in the PNG LNG Project EIS Main Report.

Disruptions to local fishing and loss of subsistence resources. During the construction phase of the project, vessels associated with the construction of the Omati River Landfall and offshore pipeline in the Omati River (e.g., pipelay vessels, anchor-handling tugs, pipe supply vessels, accommodation vessels), have the potential to interfere with local fishing activities. This may prevent local people adjacent to the area of construction from fishing during the construction activities if access to and from their fishing camps is restricted.

Hazards to local communities and other river users from project-related traffic. The transportation of project related materials to Kopi will increase the level of river traffic in the Omati-Kikori delta along the proposed barging route. This will likely inconvenience and have safety implications for the current users of the proposed barging route.

Changes in Omati River hydrology and sedimentation effects. As the local people perceive that construction of the Kutubu Petroleum Development Project pipeline lead to changes in the hydrology of the Kikori River, the same perception may also apply should changes in the hydrology of the Omati River occur following the construction of the LNG Project Gas Pipeline.

5. Recommended Management and Mitigation Measures

The following mitigation and management measures are recommended to address the issues described in Section 4.

- The project should undertake a community awareness program to inform inhabitants of villages near the offshore pipeline route regarding the offshore pipeline construction activities. Information on the timing of and the dangers associated with approaching pipelaying vessels should be passed on during the program. Local people should be requested to remain clear of the pipelaying vessels for their own safety. Consultation should include relevant aspects of access, safety and exclusion zones.
- The project should limit interfering with or restricting access to villages during construction activities in the Omati River as far as practicable.
- The project should notify local communities about project barge traffic and the associated dangers of approaching barges too closely.
- The project should undertake sedimentation and geomorphologic characterisation studies of the Omati River to collect baseline data of the portion of the river bed on which the proposed LNG Project pipeline will be laid so that any future changes can be compared to pre-construction conditions.

Resource Use Survey of the Omati-Kikori Delta
PNG LNG Project

Annex A

Field Notes

DAY ONE (27 APRIL 2008)

Discussion with Delta Kikori Store Retailers

- The Delta Fish Plant, which was run in conjunction with the Delta Kikori Store (a trade store selling food, clothes and electrical goods) (Plate A1), closed in early 2008 following 52 years of operation. The main reason for its closure was inconsistency of supply, leading to an inability to fulfil market obligations. Many of the people who had supplied the fish plant had alternative sources of income and, therefore, were not consistently involved in fishing.
- When in operation, the plant purchased fish (mainly black bass and barramundi, and more recently, catfish and threadfin salmon) directly from local fishermen, processed the fish and sold it to markets in Port Moresby. The Delta Fish Plant also provided ice to the fishermen to preserve their catch, which allowed them to fish in more distant areas. The practice of carrying iceboxes to remote fishing camps has ceased since the closure of the Delta Fish Plant.
- Following the closure of the plant, fishing is now mainly a subsistence activity (i.e., feeding for own family's consumption). Any excess catch, particularly high value species such as barramundi, threadfin salmon and large catfish, are sold opportunistically at the market in the Kikori township or to logging camps in the area.
- Sedimentation in the Kikori River (downstream from the river channel adjacent to the Kikori township) is alleged to be a problem for transport. The barge used for transporting goods to the Delta Kikori Store has a draft of 2 m and can only access the Kikori River during high tide.

Travel Along the Barging Route

- The level of fishing activity observed was not high (i.e., less than 10 people were seen fishing), possibly due to bad weather (i.e., heavy rain) and/or because it was a Sunday (i.e., people may have been at church). Less than 10 nets were seen in operation.
- A fishing camp (i.e., a temporary camp used periodically by fishermen) was visited on the south bank of a channel linking the Aiai and Auro rivers (Figure A1). The camp appeared to have been deserted as the buildings were in disrepair. The camp had a broken down smoking apparatus (Plate A2), suggesting that when in use, some of the catch was smoked for preservation.
- Several other fishing camps were seen along the barging route which appeared to be in use, however, some of these camps appeared to be occupied for longer periods rather than just used for fishing (e.g., clothes lines were visible (Plate A3)).
- People were actively fishing with nets off the Aiai River, just downstream from a logging camp at the confluence with the Ivi River (Plates A4 and A5). They were most likely from the village of Gauri, which is located opposite the camp. At many of the confluences of small creeks into larger rivers, bamboo or wooden poles have been driven into the river bed to provide anchor points for the attachment of gill nets. Few were observed to be in use and there was little evidence of fishing activity (which may have been attributed to inclement weather, and/or other activities such as attending church on Sunday).



Plate A1
Delta Kikori Store

Source: N. Goldsmith



Plate A2
Fish smoking apparatus

Source: N. Goldsmith



Plate A3
Fishing camp with visible washing

Source: N. Goldsmith

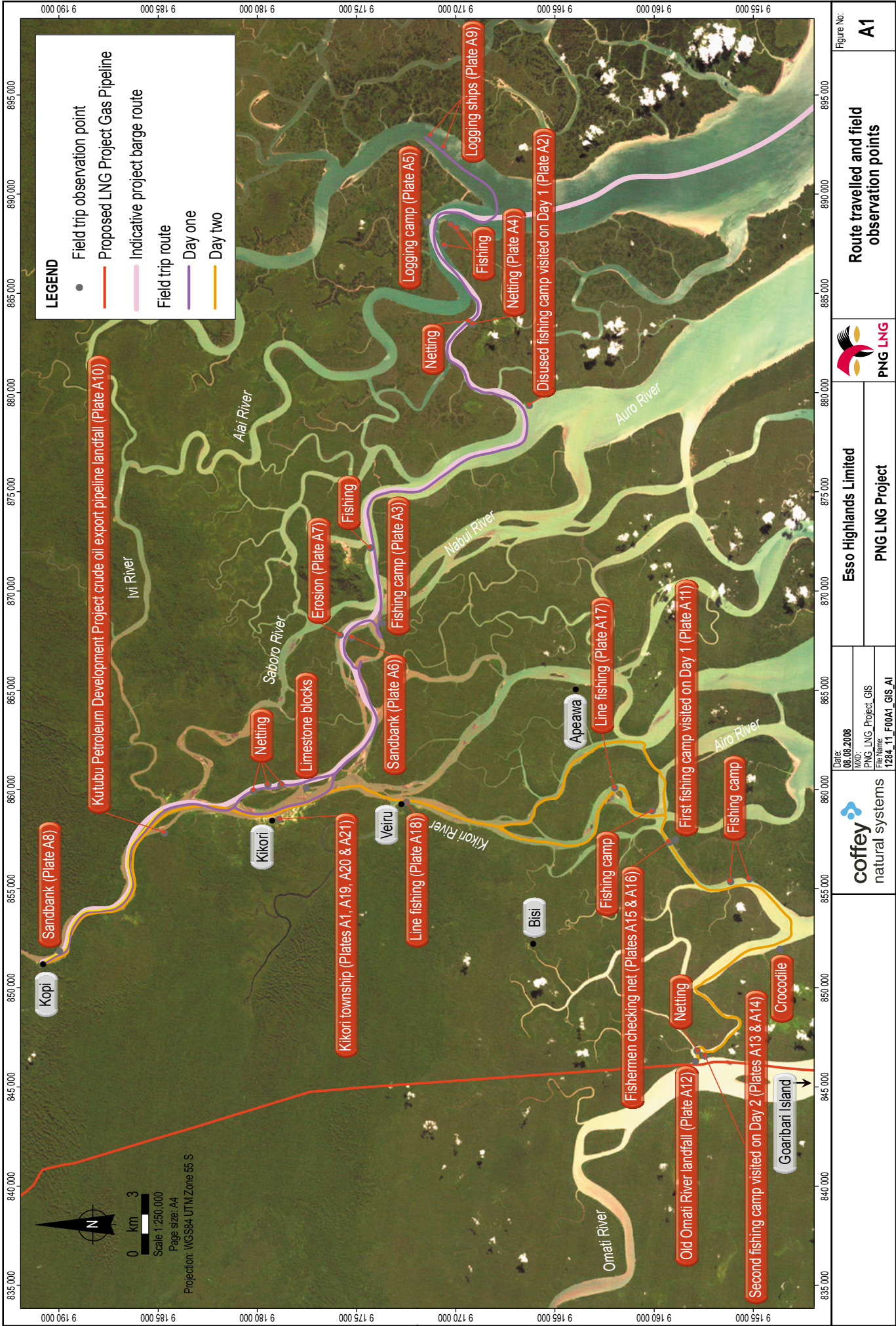




Plate A4
Netting near logging camp

Source: N. Goldsmith



Plate A5
Logging camp

Source: N. Goldsmith

- Sedimentation is evident in the Kikori River and in the Auro River from the junction of the Kikori River to Aird Hills and sandbanks and erosion was visible in some places (Plates A6 and A7).
- Discussions with Oil Search Limited Village Liaison Officers (VLOs) revealed that the local people believe that the increased sedimentation has been caused by logging activities, pipelaying or the limestone blocks allegedly placed in the Kikori River just south of Kikori village to prevent large ships navigating over the pipeline (see Figure A1).
- A sandbank that was said to have recently formed was observed just downstream of the Kopi camp (Plate A8).
- A small crocodile was seen in the Aiai River.
- Two large logging ships (Plate A9) were observed in the Ivi River upstream of its confluence with the Aiai River.
- The Kutubu Petroleum Development Project crude oil export pipeline landfall at the Kikori River, downstream of Kopi Camp, was observed to be well-vegetated and an unlikely source of sediment to the Kikori River (Plate A10, see Figure A1).



Plate A6
Sandbank in Sabore River

Source: N. Goldsmith



Plate A7
Erosion in Sabore River

Source: N. Goldsmith



Plate A8
Sandbank just downstream
of Kopi camp

Source: N. Goldsmith



Plate A9
Logging ship in Ivi River

Source: N. Goldsmith



Plate A10
Kutubu Petroleum Development
Project crude oil export pipeline landfill

Source: N. Goldsmith

DAY TWO (28 APRIL 2008)

Travel to the Proposed PNG LNG Project Omati River Landfall

- Note: Since the completion of the fieldwork component of this study, the proposed location of the Omati River Landfall has been moved approximately 400 m upstream.
- More fishing activity was observed on Day Two than on Day One, possibly as it was a weekday and/or the weather was fine.
- The Kutubu Petroleum Development Project crude oil export pipeline route along the Kikori River was followed until it joined the Nakari River. A fishing camp, located on the banks of a tributary that comes off the Kikori River to the west of the Aird River, was visited (see Figure A1) and arrangements were made to come back later in the day when the villagers were going to check their nets. Some smoked fish (barramundi, threadfin salmon, catfish and bream) (Plate A11) and sago were traded for sandwiches.
- A large crocodile was observed on the banks of the Newberry River (see Figure A1).
- The old location of the proposed Omati River Landfall was visited. The area is heavily vegetated, although an area cleared of vegetation in 2005 for then survey activities was still obvious but stable and revegetating (Plate A12).
- A fisherman was observed pulling in a net near the old location of the proposed Omati River Landfall (see Figure A1), however, the net was empty. The fisherman was staying at a nearby fishing camp close to the confluence with the Omati River (Plate A13; see Figure A1). The people at this camp had caught a large barramundi earlier in the day, which they had since cleaned and filleted (Plate A14). Discussions with the local people at the camp revealed that they were there for one month catching fish for a family gathering following a death in the family. They commonly catch mudcrab, prawn, barramundi, catfish, threadfin salmon and crocodile using nets, handlines and spears. Fishing nets are purchased from the Delta Kikori Store. They see logging barges navigating past their camp about once a week. These come from upstream in the Omati River.
- The large crocodile was seen again in the same place on the way back to the first fishing camp.
- Two fishermen from the first fishing camp were observed checking their nets, in which they caught one barramundi, one catfish and one nursery fish (Plates A15 and A16).
- While traveling upstream of the Kikori River, a child was seen in a canoe using a hand line to catch a catfish (Plate A17).
- A woman was seen line fishing from a canoe next to Vairu village and had caught two fish, possibly bream (Plate A18). Some cast nets were being used along this stretch of the river.
- On the way back to Kopi Camp, people were seen casting nets and line fishing in the Kikori River.

Visit to Market in Kikori Township

- The market in the Kikori township sold shark, catfish, nursery fish, ponytail, threadfin salmon and giant river prawn (Plates A19 and A20). A sizable quantity of fish was available. Other goods sold

included betelnut, vegetables, fruit, pork, clothes and baked goods. Several canoes, including one with a catch of fish onboard, were pulled up alongside the market (Plate A21).



Plate A11
Smoked fish

Source: N. Goldsmith



Plate A12
Old Omati River Landfall

Source: N. Goldsmith



Plate A13
Fishing camp near old Omati River Landfall

Source: N. Goldsmith



Plate A14
Barramundi (cleaned and filleted)

Source: N. Goldsmith



Plate A15
Fishermen checking net

Source: N. Goldsmith



Plate A16
Fish caught in net

Source: N. Goldsmith



Plate A17
Child line fishing

Source: N. Goldsmith



Plate A18
Line fishing catch near Veiru village

Source: D. Gwyther



Plate A19
Market at Kikori township 1

Source: D. Gwyther



Plate A20
Market at Kikori township 2

Source: D. Gwyther



Plate A21
Township, near market

Source: N. Goldsmith