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PAPUA LNG PROJECT

UPSTREAM ENVIRONMENTAL IMPACT STATEMENT

VOLUME 1: MAIN REPORT

Chapter 9: Existing Environment – Social, Economic and Cultural

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9. Existing Environment – Social, Economic and Cultural

9.1 Study Overview

The information in this chapter has been prepared from the following baseline reports, where further, more detailed information can be found:

- Upstream Community and Demographics Baseline Report (Part 14 of Volume 2).
- Upstream Governance and Economics Baseline Report (Part 15 of Volume 2).
- Upstream Community Health Baseline Report (Part 16 of Volume 2).
- Upstream Cultural Heritage and Archaeology Baseline Report (Part 17 of Volume 2).
- Upstream Land and Natural Resources Baseline Report (Part 18 of Volume 2).
- Marine and River Traffic and Transport Baseline Report (Part 22 of Volume 2).

The baseline characterization presented in each of these reports is based on a literature review and primary data collected through a community-level survey from 15 May to 3 June 2016, household survey from 14 August to 12 September 2016 and consultation with key stakeholders, as outlined in Chapter 6 and detailed in each of the social baseline reports. Traffic surveys relevant to the marine and river traffic and transport report were conducted during the freshwater and estuarine surveys in February 2017. Information has also been drawn from a human rights impact assessment (DIHR, 2017) focusing on the key topics of gender, security and conflict.

All the communities in the Project area of influence (PAOI) were surveyed as part of the community-level surveys. Those surveys revealed that several communities had the same history, the same cultural beliefs and traditional practices, as defined by language group, and the same patterns of natural resource use depending on their environmental setting or ecological zone (further described in Section 9.2.1). Combined, the surveys found that, in the PAOI, groups of communities had similar daily activities, lifestyles and values with little variability between those that shared language or ecological zone. The household survey was therefore conducted across a sample of communities from each language group and ecological zone.

The upstream study area for the social baseline studies comprises a local study area and a regional study area. The local study area corresponds with the PAOI, as described in Chapter 1. The regional study area includes the relevant provincial, district and local level government (LLG) areas. For the upstream study area, this includes Gulf Province, Kikori District, Baimuru Rural LLG and Ihu Rural LLG (Figure 9.1).

Throughout this section, where data is presented from the community-level surveys, the villages of Akoma and Kairu'u are presented as one community and shown with the hyphenated name Akoma-Kairu'u. This is because the villages are close to each other. While they retain their individual identities, they function as one community and were therefore presented together in the community-level surveys. The same applies to Ere and Kilavi which are shown in data tables herein as Ere-Kilavi and Oru, Lariau and Herekela, which are shown in data tables herein as Oru-Lariau-Herekela.

PROVINCIAL, DISTRICT AND LOCAL LEVEL GOVERNMENT AREAS

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FIGURE 9.1

SCALE: 1:1,750,000 @ A4

0 10 20 30 40 50 km

COORDINATE SYSTEM: PNG94 PNGMG94 Zone 55

- Capital city
- Provincial capital
- Local level government capital
- Town and village
- Province boundary
- Local level government boundary
- PNG LNG Gas Pipeline
- Waterway
- District areas
- PRL-15
- Export pipeline corridor
- PNG LNG Facilities

9.2 General Setting

9.2.1 Communities and Language Groups

The Project is in Gulf Province, Papua New Guinea, in the Kikori District and extends across the Baimuru Rural LLG and Ihu Rural LLG areas (see Figure 9.1). Thirty-nine villages and one government station occur in the PAOI (see Figure 3.2 and Section 9.5).

Seven distinct community groups exist in the PAOI, defined by the language they speak, i.e., Pawaia, Koriki, Iare, Ahia, Kaimare, Maipua and Orokolo; and villages in each language group have similar history, cultural beliefs and traditional practices. Traditional language, known locally as *tok ples*, is typically the first language of all villagers, although villagers usually have degrees of fluency in other Papuan languages, such as Tok Pisin and Hiri Motu, and in English. The traditional language is seen as fundamental in maintaining cultural values and thus the cultural identity of each village.

The language group is one of two features that contribute strongly to the homogeneity of the seven community groups in the PAOI; the second is the ecological zone, i.e., the environmental setting in which communities are located (Figure 9.2). Ecological zones are described in Section 7.7.3. The language that people speak defines where they came from, their ancestors and their ancestral migration history, i.e., from the land on which they originated to the land they occupy in the present. As a result, it defines their cultural values, with whom they communicate, trade and marry and, in many cases, the behavioral and social norms they are expected to observe. Language and membership of a language group influences different individuals, clans and villages to behave similarly on cultural and social matters whether they live in nearby or not.

People in the PAOI depend significantly on their natural resources for survival and wellbeing; therefore, their environmental setting significantly influences their day-to-day activities. Communities that have access to the same natural resources have similar resource use patterns and undertake similar daily activities. The natural resource use pattern and the language group illustrate the homogeneity of communities that share a language and an ecological zone. This is unremarkable, as the ecological zones themselves are based on natural characteristics upon which communities have developed particular subsistence dependencies; therefore, while language affiliation defines residency, marriage patterns, trade relationships and cultural values, among other things, the environmental context in which people live (environmental setting) determines subsistence practices, hunting and gathering activities, water availability, food intake, travel patterns and access constraints, among others. Thus, in the context of the PAOI, a community's language group and the ecological zone in which they live are seen to significantly define how those people live from day-to-day. Table 9.1 shows the villages in the PAOI by language group and ecological zone.

PRL-15 is largely unpopulated, with the Pawaia[1] people being the principal users of the PRL-15 area. Pawaian speakers reside in 14 villages in Gulf, Simbu and Eastern Highlands provinces. Approximately 4,000 people across these villages speak the Pawaian language (Lewis et al., 2016). Only two small villages[2] are in PRL-15[3]; Poroi 1 and Mapaio Fish Camp; the first is a Pawaia village, and the second is a settlement of Iare people. They are located on the Purari

1 Pawaia is a linguistic reference to a group of people who speak the same language and reside in a defined geographical territory rather than to a tribe (Kinkin & Kewibu, 2008).

2 Also known as hamlets, small settlements that associate as part of larger villages.

3 In this chapter, further references to villages and cultural heritage in PRL-15 consider the wider communities in and around PRL-15 in the PAOI.

UPSTREAM LANGUAGE GROUPS AND ECOLOGICAL ZONES

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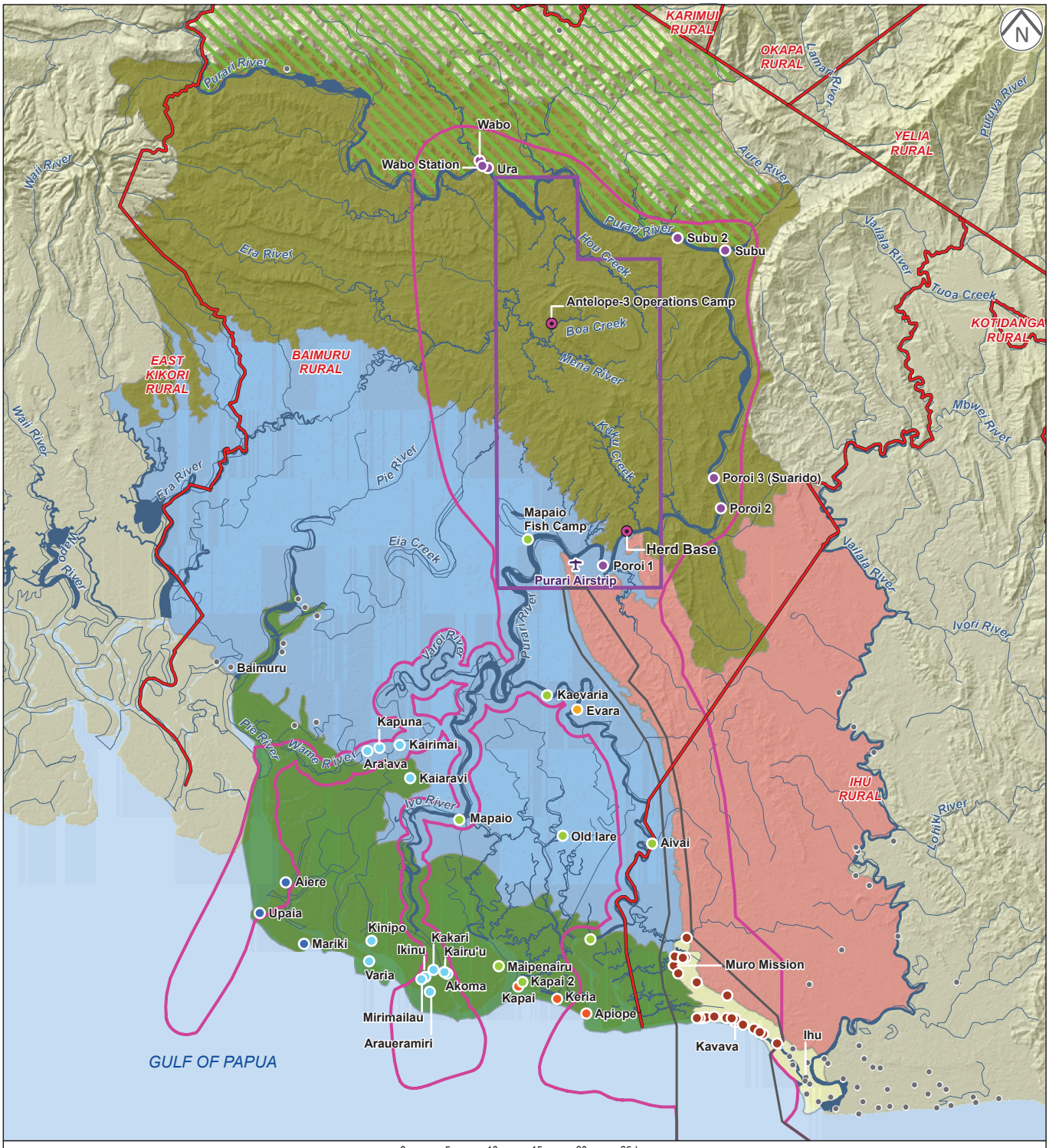
FIGURE 9.2



Communities outside of the Project area of influence have not been verified. Only government administrative centers and notable locations have been labeled for context. Language group does not represent land ownership.

River in the southern part of the license area. A government station (Wabo Station) and six Pawaia villages are located outside but near PRL-15 on the Purari River.[4]

Table 9.1 – Language Groups and Ecological Zones in the PAOI

Project Area	Language Group	Ecological Zone	Village/Station
PRL-15[1]	Pawaia	Middle Purari Hills and Delta Swamps and Plains	Poroi 1, Poroi 2, Poroi 3 (Suarido), Subu, Subu 2, Ura, Wabo, Wabo Station
River Transport Corridor[2]	Ahia	Delta Swamps and Plains	Evara
	Koriki	Delta Swamps and Plains and Mangroves	Akoma-Kairu'u, Ara'ava, Ikinu (including the hamlets of Mirimailau and Araueramiri), Kairimai
	Iare	Delta Swamps and Plains and Mangroves	Aivai, Aumu, Kaevaria, Mapaio, Mapaio Fish Camp (Nea Creek)
	Kaimare	Mangroves	Aiere, Upaia
	Maipua	Mangroves	Apiope*
Export Pipeline Corridor	Orokolo	Southeast Coast	Arehava 2, Avavu, Ere, Harevavo, Hepere, Herakela (including the hamlet of Hiloi), Hohoro, Huruta, Iuku, Kaivukavu, Kavava (including the hamlets of Hururu, Mirimurua and Miha-Kavava), Kilavi, Larihairu, Lariau, Marea, Mareke, Oru, Paevera

* Only one Maipua village is located in the PAOI, but three Maipua villages were surveyed for sample robustness. This table shows villages in the PAOI.
[1] The Mapaio Fish Camp is in PRL-15 but is an Iare settlement, listed under River Transport Corridor.
[2] Except for the Mapaio Fish Camp, which is in PRL-15.

In the northern part of the river transport corridor in the village of Evara are the Ahia speakers that originate from the Vailala River catchment to the east. Ahia has been classified as a dialect of the Keoru-Ahia language. While some 6,000 people speak Keoru-Ahia, only 700 people speak the Ahia dialect (Lewis et al., 2016).

Toward the coast, the onshore export pipeline corridor presents a relatively diverse social situation with a generally low inland population scattered or concentrated in small villages along riverbanks between Muro Mission (the Muro area) and Orokolo Bay. Much denser population resides in larger villages and hamlets along the gulf coastal strip of Orokolo Bay. Orokolo-speaking people inhabit this area. Approximately 10,000 people speak the Orokolo language, some of whom reside outside the PAOI).

The Koriki, Iare, Kaimare and Maipua languages are spoken by people living along the three Purari River delta distributaries, that may be used for Project transport and related activities, namely, the Purari, Urika-Ivo and Wame-Varoi rivers, called herein the river transport corridor. People from these language groups indicated that there is some commonality in their languages and in their ability, therefore, to have some understanding of each other's language; however, they differentiated between the languages. The number of people living in the villages in which these languages are spoken is relatively small (ERIAS Group, 2016a; NSO, 2013), as follows:

- Koriki – approximately 2,500.
- Iare – approximately 2,200.
- Kaimare – approximately 1,200.

4 Two other stations are in the PAOI (but not in the PRL-15 area) – the Kapuna Health Center is on one and the Muro Mission is on the other. Neither of these station areas accommodates 'communities' as such, but rather only the staff, patients or students attending the facilities. Thus, they are not considered 'communities' in this report.

- Maipua – approximately 400.

An estimated 36 migrant families live in villages in the PAOI, excluding those living on Wabo Station.[5] Conversely, 70% of villages in the PAOI indicate that 'more than 100 people' from their village have moved away to live in other parts of Papua New Guinea. In the past, out-migration has greatly exceeded in-migration, although in-migration has occurred at Ura and Wabo Station over the past decade.

9.2.2 Historical Context

The Pawaia people traditionally are semi-nomadic, living in small settlements. Until the 1920s, the Pawaias lived north of the Purari River in a remote, mountainous area encompassing parts of Gulf, Simbu and Eastern Highlands provinces. Today, villages are larger and more permanent than they were during pre-European contact times; however, family groups still spend long periods in temporary camps for subsistence purposes. Pawaia people have had limited interactions with outsiders and communities to the south, although prior to the 1940s, they obtained *Hiri*[6] shell valuables from coastal villagers, which they exchanged for bird of paradise feathers. In the 1960s, the then colonial government[7] and Christian denominations encouraged Pawaia people to establish permanent settlements for the provision of services and religious instruction. The settlements of Ura, Wabo and Poroi 2 were reportedly established in 1974 as a result of the proposed Purari River Dam Project;[8] although, it is likely the Pawaias had temporary fishing camps in the vicinity much earlier. Poroi 1 was established in the 1950s, abandoned and then re-established in 2007. Subu was established in 1996. The villages of Poroi 3 (Suarido) and Subu 2 were more recently established, in the case of the latter, because of significant flooding of Subu in 2014 when approximately half of its residents relocated.

The combination of small-sized settlements, frequent relocations, a limited inventory of material cultural items, and environmental conditions that are not conducive to preserving archaeological materials has created a situation whereby Pawaia cultural activities have left rare and faint archaeological signatures (Part 17 of Volume 2).

The people living along the riverways on the Purari River delta (i.e., from the Iare, Kaimare, Koriki and Maipua language groups) share common cultural practices. In the past, villages in this area were much larger than today and sometimes home to more than 2,000 people. These large villages were structured around men's houses called *ravi*. Each *ravi* was the focus of social and cultural life for the section of the village with which it was associated. The Koriki, Iare, Maipua and Kaimare language groups indicated that they all originated from further up the Purari River and relocated southward over time. It appears that villages were initially established in the Purari River delta between World War I and World War II, possibly to be closer to government services, with coastal villages being established after World War II, often in an attempt to grow coconuts and access coastal shipping services to sell copra.[9]

5 A community-level survey was not undertaken at Wabo Station; however, the household survey indicated that five of the seven families living at Wabo Station were born elsewhere.

6 *Hiri* is the name for the traditional trade voyages that carried the much-prized Motu cooking pots to the people of the Gulf of Papua and brought back plentiful supplies of sago for the Motu.

7 Between 1951 and 1964, Papua New Guinea was governed by a 28-member legislative council set up by Australia, and by a judiciary and a public service. An elected House of Assembly replaced the council in 1964.

8 The proposed Purari River Dam Project involved a feasibility study for a dam on the Purari River near Wabo. The Australian Snowy Mountain Engineering Corporation, the Japanese Nippon Koei, and the Government of Papua New Guinea jointly commissioned the study.

9 Copra is the dried meat or kernel of the coconut.

The Orokolo speakers also believe they originate from the middle or upper reaches of the Purari River. They moved to a location known as Popo, from where they dispersed to their current locations along Orokolo Bay and inland in the area surrounding Muro Mission (Muro area), approximately 10 km inland from Orokolo Bay. The ancestral Popo village site (Plate 9.1) is of archaeological note. Archaeologist Jim Rhoads investigated the site in 1976, and his excavations indicated the site was used around 400 years ago with evidence of Motu *Hiri* trade.

Plate 9.1 – Cultural Heritage at Popo

Photo: Robert Skelly.

Also in the Orokolo Bay area are the archaeological investigations east of the PAOI and east of the Vailala River that have revealed pottery with decorations stylistically akin to those found on Lapita pottery. Lapita peoples were the bearers of the earliest known ceramic tradition in the Oceanic region. Lapita ceramics first appeared in the Bismarck Archipelago, east of mainland Papua New Guinea, from 3,470 to 3,250 cal BP[10] (Denham et al., 2012). At the time, Lapita peoples were expanding westward along the south coast of Papua New Guinea. Lapita people are likely to have established a presence on the ancient beaches of Orokolo Bay; therefore, it is possible that Lapita and post-Lapita sites of national and international significance may occur on the deflated dunes and beach plains 2 to 7 km inland from the present-day coastline in Orokolo Bay.

Research shows that, some 1,200 to 1,500 years ago, pottery sherd deposition increased ten-fold, suggesting that populations were flourishing during a period of increased communication and interactions between beach-fronting villages on the south coast of Papua New Guinea (Skelly, 2014). Then a 500-year-long cultural hiatus appeared that corresponds with the Ceramic Hiccup, a period of social disruption that affected villages from the Kikori River delta in the west and eastward as far as Caution Bay near Port Moresby.

People returned to the south coast some 700 years ago, and cultural activity in coastal villages appears to increase some 300 to 500 years ago, likely signaling the emergence of social relationships antecedent to the ethnographic *Hiri*. The *Hiri* involved annual trading voyages by Motu and Koita seafarers from villages near present-day Port Moresby. These voyages involved large fleets of trading vessels sailing to the Gulf of Papua to exchange pots (Plate 9.2) for sago.

10 Calibrated years before the present.

Plate 9.2 – *Hiri* Trade Pots

Photo: Robert Skelly.

The Ahia people originate from the middle reaches of the Vailala River southeast of Evara and have generally been known as the Kaura in the past. Residents of Evara are predominantly from the Uhe tribe. Their settlement history was not disclosed, possibly because they are involved in court cases connected to land ownership and logging.

All villages in the PAOI maintain ancestral oral traditions that detail ancestral migration stories and clan origins. Generally, ancestral migrations are thought to be due to social disruption and changing environmental conditions. In addition, coastal progradation is cited as a core theme in the oral traditions of ten villages (i.e., Kairimai, Kaevaria, Upaia, Harevavo, Kavava, Kaivukavu, Larihairu, Iuku, Marea and Mareke).

All communities trace clan origins inland, often to highland locations outside the PAOI except the villages of Marea, Iuku and Kavava located in eastern Orokolo Bay, where migrations reportedly commence from the Vailala River headwaters and track northeast. The migrations from the highlands generally tracked southward toward the headwaters of the Purari River.

Specific details of ancestral migrations are typically confidential within clans and are passed from father to son. The exception is Upaia where ancestral migration stories are passed on to both sons and daughters. The method of maintaining and protecting ancestral migration stories within each individual clan rather than sharing them across the broader community has the potential to increase their vulnerability to loss; this concern was specifically expressed by community members at Ere and Kilavi.

9.2.3 Land Ownership

The people's contemporary connection to their land is based in their ancestral origins. The majority (97%) of land in Papua New Guinea is under customary ownership, and most of the population resides on customary-owned land where it has a right to live and a means to produce. In the PAOI, all land is customary owned except Wabo Station, Muro Mission and Kapuna Health Center, which have been alienated. Alienated land is no longer held under customary ownership because it has been excised by the Government as either state land (2%) or private freehold land, including conditional freehold land (1%). Wabo Station is a government station. Muro Mission and Kapuna Health Center are mission stations on which services, such as education and health facilities, were established.

Land ownership in the PAOI is vested in clans or groups of families with a common lineage. Clan land generally includes common areas of land in which all clan members can fish, hunt and collect resources and specific land areas allocated to families where people will live and make gardens. Land areas allocated to families are most often the more fertile where gardens can be grown and, because of this fact, are generally close to where villages have been established.

The clan leader, almost always a male, grants usufruct rights on behalf of the clan to control, manage and use the land. The land is generally held on a patrilineal basis, passing from father to the first-born son; however, it is not the ownership of the land that is inherited, as the land remains with the clan, but the right to use the land.

9.3 Governance

9.3.1 Traditional Leadership

As described in Section 9.2, in the PAOI, people are unified by language. Some language groups have a leadership hierarchy, while others vest leadership at a clan level, e.g., among the Orokolo communities, there exist multiple clan leaders and a paramount chief, that is, a clan leader chosen to represent all the clans, not just the clan from which he originates.

A clan is a group of families with a common ancestor. A clan will identify themselves and their customary-owned land through oral histories, including genealogies, stories, beliefs, customs and practices. Most clan members live on their customary-owned land, although urban migration is changing this. Clan ownership of customary-owned land is recognized in the Constitution of the Independent State of Papua New Guinea. Clan leaders are usually older males and are often the first-born male of the previous clan leader.

Most rural Papua New Guineans have rights over land as part of a clan; therefore, they generally have the means to provide their basic needs and a sense of independence (Jones & McGavin, 2015). The clan, however, provides a broader safety net for its community. The *wantok* system reinforces the primary allegiance to one's clan, placing the obligation of kinship, along with the expectation of reciprocity, on its members (Mohanty, 2011). At the same time, it can place pressure on its people to provide money or favors to *wantoks*.

Clans in the PAOI continue to practice, to varying degrees, some level of traditional leadership. Traditional clan leaders have the authority to speak on behalf of their community, although consultation among the group may be expected before decisions are made or shared with outsiders.

One of the most important roles of traditional leaders is to manage communally owned land. This may involve educating other members about the land boundaries and their history; defending the boundaries; allocating land to families or family groups, e.g., for food gardens; and overseeing any decisions that involve the use of communal land.

The role of traditional leaders has changed as government officials and church leaders have played more prominent roles in various aspects of village life.

9.3.2 Religious Leadership

The spread of Christianity in Papua New Guinea from the 1800s had a marked effect on traditional society, including introducing a new layer of village leadership. The churches played a major role in expanding plantation agriculture, in particular coconut and copra production in Papua New Guinea, and expanding schools and health services in rural areas. Church agencies continue to play an important role in delivering both health and education services. Church leaders participate in the functioning of the village in terms of leadership, e.g., maintaining the

peace, resolving disputes, and providing youth leadership and support for the elderly and other disadvantaged groups.

Most (i.e., 97%) villages reported having religious leaders during baseline surveys.

9.3.3 Government Administration

Governance in Papua New Guinea is also the role of government, which, under the Constitution of the Independent State of Papua New Guinea, balances contemporary and traditional leadership. The constitution declares the underlying law to consist of the constitution, customary law and common law – indicating the importance and complexity of a governance system that prioritizes both traditional custom and a modern administration system.

Papua New Guinea's public sector includes three tiers of government (i.e., national, provincial and local) and the national public service, which has staff based at national, provincial, district and local government levels.

The top tier is the National Government, headed by a Prime Minister. The Prime Minister is appointed by the Governor-General on the proposal of having been elected by Parliament. The cabinet, known as the National Executive Council (NEC), is appointed by the Governor-General on the recommendation of the Prime Minister. At the national level, the country is divided into four regions: Highlands, Islands, Momase and Southern.

Papua New Guinean provinces are administrative divisions representing branches of the National Government rather than a federation of provinces. There are 20 provinces, one autonomous region (Bougainville) and one capital district (National Capital District). The upstream Project is in Gulf Province,[11] which is in the Southern Region with its capital located at Kerema. Appointed provincial administrators administer each province. The NEC makes appointments at the recommendation of the Provincial Executive Council and Department of Personnel Management.

The administrative divisions in the provinces are districts and, within the districts, LLG areas. For census purposes, each LLG area is divided into wards, and the wards are divided into census units. A ward may contain more than one village. Gulf Province is divided into two districts: Kerema and Kikori. The Project is in Kikori District, which has its capital in Kikori. The Provincial Administrator appoints the district administrators, who administer each district.

The Kikori District comprises the LLG areas of Baimuru Rural, East Kikori Rural, Ihu Rural and West Kikori Rural. The Project is in the Baimuru Rural and Ihu Rural LLG areas. Elected LLG presidents administer the LLGs. Baimuru Rural LLG area contains 23 wards and 45 census units, while Ihu Rural LLG area contains 22 wards and 76 census units. Eighteen wards occur in the PAOI, representing 39 villages; and an elected ward councilor represents each ward.

Following independence in 1975, Papua New Guinea's provinces were assigned responsibility for delivering core basic services, although the provinces remained under National Government control. In 1998, new legislation (*The Organic Law on Provincial Governments and Local-level Government 1998*) was introduced to achieve further decentralization. The reforms intended to relocate many public servants to outlying areas in an attempt to bring services to the people. The reforms also proposed to strengthen a bottom-up system of representation, where the people elected their ward representatives and one of the ward representatives was elected as the LLG President, a position often referred to as the councilor. Although the LLGs have broad powers, including the ability to make local laws, they receive limited funding from the National

11 Chapter 9 (this chapter) characterizes the social, health and cultural setting of the upstream Project components in the Gulf Province only. Baseline information on marine fisheries and resources is presented in Chapter 8.

Government and, in most parts of Papua New Guinea, face challenges in delivering services due to capacity constraints and a lack of support from national or provincial government.

The National Government has recently introduced several further changes to improve service delivery, including increased funding for the provincial, district and LLG services improvement programs.

A ward councilor is supposed to represent each village, have a ward development committee, and be represented by a village court and land mediator; however, only 13 of 35 villages surveyed[12] have all four positions in place. Orokolo villages are better organized from a government perspective, which may reflect the closer proximity and easier access of these villages to Kerema compared to some other villages in the PAOI. By contrast, relatively few Pawaia villages have a government presence, which is attributed to the relative isolation of the Pawaia villages. It may also be a consequence of smaller villages, particularly for Poroi 1, Poroi 3, Subu and Subu 2.

Other than education and health facilities, many of which are managed by church agencies, government agencies have a minimal presence in the PAOI villages and have limited influence on the villagers' day-to-day lives.

9.3.4 External Support

External support or assistance provided to a village for any public goods has been provided to all but five villages in the PAOI in the past. By far the most common source of external support has been for water supplies; however, assistance has also been provided for schools, health facilities and communications. According to the communities surveyed, assistance has been provided by the European Union, the Department of Foreign Affairs and Trade (formerly called AusAID), the Japanese International Cooperation Agency, the previous PRL-15 operator InterOil, PNG Energy Developments Limited (no longer operating), logging companies and the Kapuna and Muro missions.

No non-government organizations have a permanent presence in the PAOI, although Médecins Sans Frontières has recently established a base at Ihu, east of the PAOI, to implement a program to help combat tuberculosis and aims to establish another base at Kapuna.

9.4 Economy and Employment

9.4.1 Large-scale Industry

The formal economy in Papua New Guinea is dominated by resource exploration and production, commercial agriculture, tuna processing, logging and a small manufacturing sector. The informal economy, which supports approximately 85% of the population, is primarily dependent on subsistence agriculture (ADB, 2015).[13] Papua New Guinea has experienced strong growth in gross domestic product over the past decade, with much of the growth in 2014 and 2015 attributed to the PNG LNG Project.

The main large-scale industries in Gulf Province are oil production and petroleum exploration, prawn fishing and logging. Since 1998, oil has been extracted from the Gobe Main and South East Gobe oil fields located in the Kikori River catchment. Although not yet in operation, the

12 All 39 villages in the PAOI were surveyed as part of the social baseline surveys; however, at four locations, for the reasons described in Part 23 of Volume 2, a selection of key information, as opposed to the full suite, was collected. Therefore, for some topics in this section, the report describes the findings from 39 villages and for others for 35 villages.

13 The informal economy is not monitored by any form of government nor is it taxed. Unlike the formal economy, activities of the informal economy are excluded from the gross national product or gross domestic product.

Papua LNG Project has provided a source of local employment and various other services, particularly among Pawaia villages, during its exploration and development stages.

Most of PNG's prawns are captured in the Gulf of Papua; however, all are processed in Port Moresby. The province contains five large-scale logging operations; however, benefits from logging are not acknowledged at the community level, and the provincial government does not benefit financially (Gulf Provincial Government, 2011).

The only large-scale economic activity in operation in the PAOI is the Vailala Block (Blk) 3 logging project operated by Frontier Holdings. Activity in Vailala Blk 3 is reportedly winding down and Frontier Holdings is expected to move into Vailala Blk 2 within the next year or two (Part 7 of Volume 2). Turama Forest Industries has a permit to log in Baimuru Blk 3, which covers all of PRL-15, but no logging is occurring at present. Both Frontier Holdings and Turama Forest Industries are affiliates of the Rimbunan Hijau (PNG) Group, a Malaysian logging company. Vailala Blk 3 operates over 196,353 ha, some of which overlap the eastern part of the PAOI. Volumes available for harvesting from the forest are of relatively low quality and are the equal lowest in Papua New Guinea. The main commercial species (i.e., *Terminalia* spp. and *Pometia pinnata*) account for approximately 10% of the available saleable volume (Part 7 of Volume 2). Barges transport logs from the logging area on the Purari River distributaries. As shown in Table 9.2, only 6% of males over 16 years in the PAOI are currently employed in logging or milling. Previously, 9% of males and 8% of females over 16 years in the PAOI have worked in logging or milling.

Other high-value but small-scale forestry products are available from the PAOI. These include eaglewood, which is harvested across Papua New Guinea for its aromatic resin, and massoy bark. Massoy bark, harvested from *Cryptocarya massoia* trees, is likely to occur in the hill forests of the PAOI; however, there is no known commercial harvesting of these products in the PAOI.

Small-scale forestry is almost absent from the PAOI other than at Paevera where a portable sawmill is based.

9.4.2 Small-scale Industry

Until the 1980s, the Papuan coast was a major source of copra, and copra was the main source of income for coastal villages. Since coastal shipping services stopped, local people have turned to commodities that could be sold locally or commodities with higher unit values that could be transported economically outside the local area.

The most common sources of income in the PAOI are the sale of betel nut (Plate 9.3), fish, crabs, garden produce and sago (Plate 9.4); this is discussed further in Section 9.5.5.1. Small business activities such as selling fuel and operating trade stores also contribute to household income for some people (Section 9.5.5.1).

Plate 9.3 – Betel Nut is the Main Source of Income for Many PAOI Villages

Plate 9.4 – Garden Produce at Kaivukavu Market

Photos: ERIAS Group.

9.4.3 Employment

Most people in the PAOI are involved in subsistence activities and are not formally employed (see Section 9.8.7). During the household survey, only 15% of males and 7% of females reported to be in formal employment. The most common jobs include teachers, village court officials and ward councilors, carpenters and pastors (Table 9.2).

The main employers are the government, which employees 32% of people, church groups (19%) and TEP PNG (13%). Other employers are likely to be stores and business activities outside the PAOI. Most (60%) people, whether in formal or informal employ, work in the village in which they live.

Table 9.2 – Current and Previous Employment (People Aged 16 Years and Over) (%)

Employment Type	Current Employment Males	Current Employment Females	Previous Employment Males	Previous Employment Females
Laborer	6	5	15	8
Pastor	8	5	7	9
Policeman	5	0	0	0
Village court officials/ councilors	10	12	1	1
Logging/milling	6	0	9	8
Fisher	0	0	1	0
Driver	3	0	4	5
Carpenter	10	2	11	0
Mechanic	1	2	3	1
Electrician	1	0	2	0
Welder	1	0	2	0
Pipefitter	0	0	1	0
Loadmaster	3	2	4	2

Table 9.2 – Current and Previous Employment (People Aged 16 Years and Over) (%) (cont'd)

Employment Type	Current Employment Males	Current Employment Females	Previous Employment Males	Previous Employment Females
Stevedore	1	0	1	1
Supervisor	0	0	1	2
Operations/maintenance	0	0	2	0
Administration/office/clerical	2	5	6	17
Cook/catering	5	5	9	6
Security	4	5	8	1
Cleaner	2	0	0	2
Teacher	9	37	2	5
Health worker	4	2	0	2
Other technical jobs	0	0	5	3
Other*	19	19	8	26

* 'The Other' category contains any employment type that was mentioned by household survey participants that was not one of the 28 employment types listed on the survey form.

Approximately 46% of males and 14% of females aged 16 years and above indicated that they had some previous formal work experience. As shown in Table 9.2, the most common types of current employment are teachers, village court officials and ward councilors, pastors, carpenters and cooks, while the most common types of previous employment were laboring positions, logging/milling, and carpenters for males and administration/office/clerical, pastor, logging/milling and laborer for females; however, employment experience in a range of other technical jobs was also identified, including plumbers, plasterers, painters and surveyors.

9.5 Community Demographics

9.5.1 Population and Household Characteristics

9.5.1.1 Population

The combined population in mid-2016 of the 39 villages and one government station in the PAOI was 12,763 (ERIAS Group, 2016a). The population of each community[14] in the PAOI is shown in Table 9.3. The average population per village is 317; however, village size varies considerably between coastal and inland locations. The largest village is Kavava (Orokolo coast) with 962 residents, and the smallest settlement is Mapaio Fish Camp (PRL-15) with 32 residents. The PAOI includes 13 coastal villages and 27 inland villages.[15] Population density is much higher in coastal areas compared with inland areas. Coastal villages are also typically larger than inland villages and often coalesce, forming long strips of habitation along Orokolo Bay.

The average population density across Papua New Guinea is 15.7 people/km^2 and the total population is 7.321 million. The average population density is much lower in Gulf Province (i.e., 4.6 people per km^2, total population 121,128) and lower again in Kikori District (i.e., 1.9 people per km^2, total population 41,232). For Kikori District, the low population density reflects a relatively large area of land that is isolated and poorly suited to human habitation due to large expanses of

14 The term community is used as the generic term referring to villages, settlements and government station settlements in the PAOI. Hence there are 40 communities in the PAOI.

15 Coastal villages are those living on or within 1 km of the sea and whose subsistence is mainly from marine resources, and inland villages are those who do not live near the sea and whose subsistence is mainly from forest resources.

lowland swamp and mangrove that are frequently inundated and, therefore, are particularly unfavorable in terms of subsistence food production. The population density of Ihu Rural LLG (i.e., 6 people per km^2, total population 15,815) is substantially higher than that of Gulf Province and Baimuru Rural LLG (i.e., 1.5 people per km^2, total population 11,424) (NSO, 2013). Ihu Rural LLG supports a relatively densely settled population along the Papuan coast, whereas the Baimuru Rural LLG population is inland and sparsely settled, much of it being along the Purari River and its tributaries.

Table 9.3 – Population of Villages In the PAOI

Community	Population (Persons)	Households	Average Household Size
PRL-15			
Wabo	542	73	7.4
Wabo Station	108	22	4.9
Ura	229	42	5.5
Subu	62	11	5.6
Subu 2	97	13	7.5
Poroi 2	301	44	6.8
Poroi 1 (Rainbow)	34	10	3.4
Poroi 3 (Suarido)	45	8	5.6
Mapaio Fish Camp	32	5	6.4
Export Pipeline Corridor			
Evara	542	67	8.1
Hepere	297	51	5.8
Ere/Kilavi	396	75	5.3
Avavu	283	42	6.7
Huruta	246	45	5.5
Arehava 2	96	13	7.4
Paevera	294	47	6.3
Harevavo	651	100	6.5
Herakela	331	66	5.0
Hohoro	70	12	5.8
Iuku	514	80	6.4
Kaivukavu	640	101	6.3
Kavava	962	178	5.4
Larihairu	450	73	6.2
Mareke	808	145	5.6
Marea	435	79	5.5
Oru/Lariau	367	69	5.3
River Transport Corridor			
Apiope	301	45	6.7
Aumu	244	31	7.9
Aivai	107	13	8.2
Kaevaria	113	17	6.7
Akoma/Kairu'u	549	68	8.1
Mapaio	859	152	5.7
Upaia	227	41	5.5
Ara'ava	751	113	6.7

Table 9.3 – Population of Villages In the PAOI (cont'd)

Community	Population (Persons)	Households	Average Household Size
River Transport Corridor (cont'd)			
Aiere#	50	14	3.6
Kairimai	386	62	6.2
Ikinu	294	42	7.0

Source: ERIAS Group (2016a). # Source: NSO (2013).

9.5.1.2 Age and Gender

The average age of people in the PAOI is 19 years (ERIAS Group, 2016b), which is the same as for Papua New Guinea. A population pyramid for the PAOI is presented in Figure 9.3.

Results of the household survey indicate a sex ratio[16] of 105 compared to 108 nationally, 40% of people are less than 15 years of age compared to 36% nationally and 7% are aged 55 years and above, which is the same as for Papua New Guinea. The average household size for the PAOI is 6.7, compared to 5.3 for Papua New Guinea. The dependency ratio[17] is 89, compared to 75 for Papua New Guinea. Overall, the PAOI is characterized by a very young population and large household sizes (Table 9.4).

Table 9.4 – Population and Demographic Indicators by Language Group

Language Group	Sex Ratio	Average Household Size	Population Less Than 15 Years of Age	Population 55 Years of Age and Above	Dependency Ratio
Pawaia	123	7.9	45%	5%	100
Ahia	106	7.0	55%	2%	133
Koriki	92	9.2	39%	10%	96
Iare	102	7.6	33%	7%	67
Kaimare	95	3.8	43%	7%	100
Maipua	98	7.7	38%	5%	75
Orokolo	121	7.4	39%	9%	92
Total	**105**	**6.7**	**40%**	**7%**	**89**

Source: ERIAS Group (2016b).

Table 9.4 indicates differences in key demographic indicators between language groups:

- The Pawaia and Orokolo villages have a higher proportion of males than other villages.
- Household size is relatively low among the Kaimare villages (3.8 persons).
- Ahia has the largest proportion of people below 15 years of age and the fewest aged 55 years and above, resulting in an exceptionally high dependency ratio of 133.

9.5.1.3 Marriage and Divorce

In the past, polygamous marriages were common, particularly among the Koriki people (Williams, 1924). This has largely changed; results from the 2016 household survey indicate that only 3% of marriages are polygamous. The percentage of polygamous marriages by language group is:

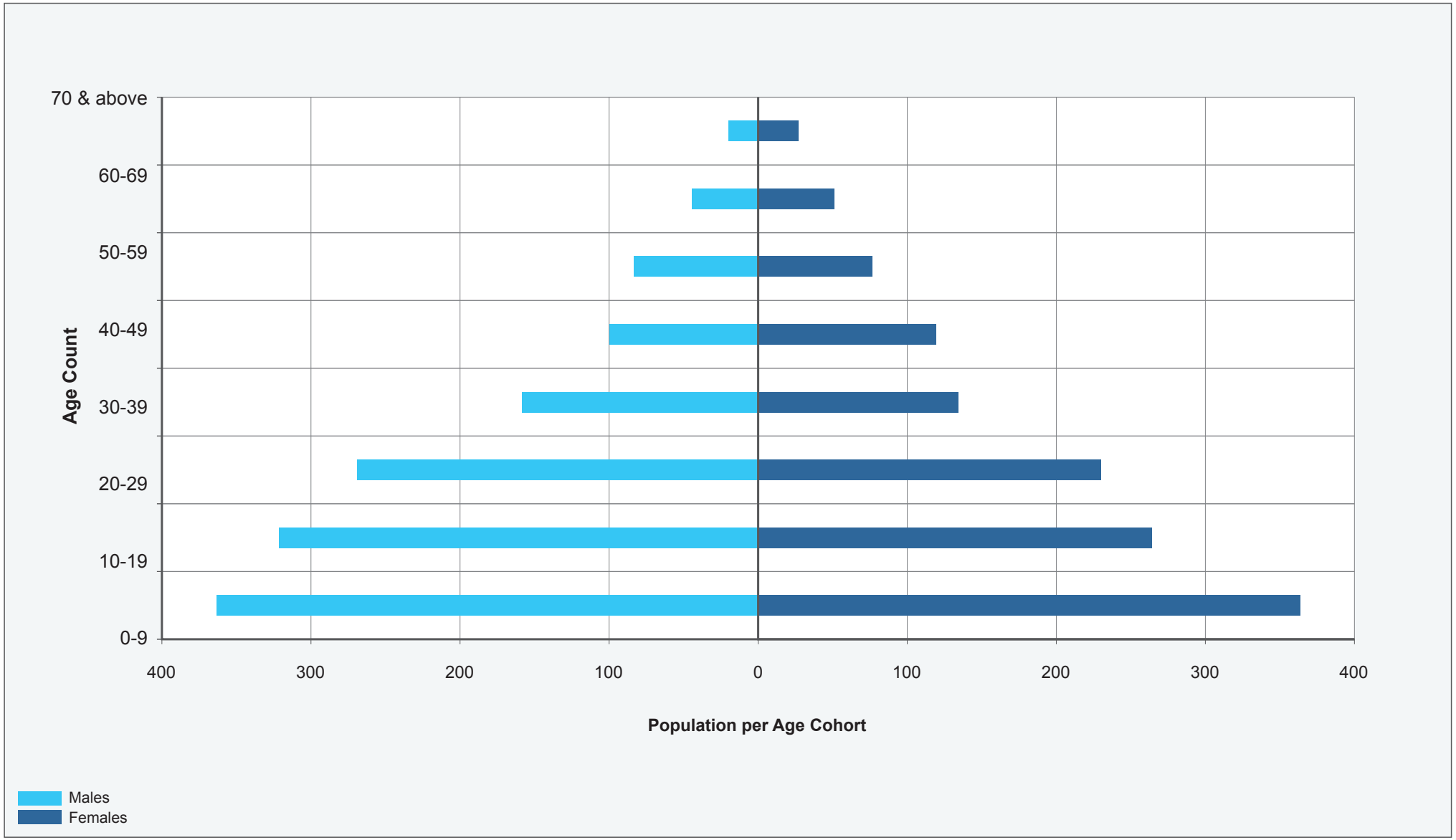
- Pawaia: 8% of households.
- Iare: 5% of households.

16 The number of males per females, i.e., there are 105 males for every 100 females.
17 The number of people aged less than 15 and those aged more than 55 years, as a proportion of the number aged between 15 and 55.

POPULATION PYRAMID FOR PAOI, 2016

Papua LNG Project | Environmental Impact Statement

FIGURE 9.3



- Maipua: 6% of households.
- Orokolo: 2% of households.
- Koriki, Kaimare, Ahia: 0% of households.

No males under 20 years of age were married, and 10% of females under 20 years of age were married. In Pawaia communities, females were married as young as 10 years old; and in the Koriki communities, it was not uncommon for women to marry as late as 40 years old. The average marrying age range for females is 15 to 22 years. The *Marriage Act 1963* has a minimum age of marriage of 18 years for men and 16 years for women, with judges able to allow marriages involving boys aged 16 years and girls aged 14; but this act is not applicable to customary marriages.

Divorce and separation is uncommon and, in the case of some Pawaias, has been alleged to lead to repercussions, including sorcery. Divorce may also involve negotiations between the families regarding the bride price and possible reimbursement, providing another disincentive for divorce among Pawaias and other language groups.

9.5.2 Religion

The main religious denominations in Gulf Province are the Catholic, United, Seventh-day Adventist and Lutheran churches. Several other churches are present, including Assemblies of God, New Tribes Mission, Reform Revival, Bahai, Pentecostal, Baptist and Christian Life Center. The churches have one representative in the Provincial Assembly. Church presence has contracted in Gulf Province over the past 40 years while remaining a central part of village life.

Christian churches in the PAOI were particularly active in coastal areas in the twentieth century, establishing bases such as Muro Mission; however, the churches were also influential inland, where, e.g., the Lutheran Church established Poroi Primary School.

9.5.3 Migration

Excluding people who in-migrate to marry, relatively few people have migrated into villages in the PAOI. Only 12 villages (39% of villages surveyed) contain people who have migrated into the PAOI. Of these, nine villages contain pastors, health workers or teachers (and their families) who have migrated specifically for employment purposes, while only three villages (Ura, Evara and Apiope) contain other migrants. In total, it is estimated that the PAOI villages include approximately 36 migrant families, which represents less than 2% of the households in the PAOI.

Around 17% of the villages included in the village leader focus group discussion, as part of the community-level surveys, indicated that they would allow unrelated families to relocate to their village on a permanent basis. The vast majority stated that outsiders could not come and live on their land unless they had a good reason, such as being pastors, health workers or teachers.

Approximately 70% of the villages providing an estimate of the number of people out-migrating from the PAOI to other parts of Papua New Guinea indicated that more than 100 people had migrated in the past. Given the average village size of 317, out-migration has been large. Discussion with village leaders indicated that many former villagers now reside in Port Moresby and other parts of Papua New Guinea, including Kerema, Lae, other provincial centers and various mining camps. Generally, out-migration was associated with the search for employment.

9.5.4 Housing and Community Infrastructure

9.5.4.1 Housing

Most (73%) houses are made of traditional materials, i.e., hardwood poles, split black palm floors, woven sago panels on the walls and a roof made of sago, nipa palm or grass (Plate 9.5). Twenty-five percent are semi-improved, incorporating sawn timber or sheets of roofing iron; and 2% are of modern design, i.e., completely made of sawn timber, iron roofing and other purchased building materials. More than 99% of houses are raised above the ground, particularly in the Purari River delta, to avoid inundation related to high tides or river flooding.

Most (97%) families live in their own house, with the remaining 3% staying with friends or relatives. If a house is destroyed, e.g., by flooding, the family will often stay with relatives until they have an opportunity to construct a new house. This may take several months or longer.

Plate 9.5 – Typical House (Kaevaria)

Photo: ERIAS Group.

9.5.4.2 Energy Sources

Twenty-eight percent of households have access to a generator, and 53% of households have access to solar panels providing electricity (Plate 9.6). Power from generators or solar panels is used predominantly for lighting and charging mobile phones; however, some households use the power to run refrigerators, freezers or other electrical appliances.

Plate 9.6 – Solar Panels and Battery at Maipenairu

Photo: ERIAS Group.

Other sources of lighting include firewood and *bom* torches (traditional torches made of palm fronds). Firewood is the main source of fuel for cooking throughout the PAOI.

9.5.4.3 Water and Sanitation

Water

The main sources of drinking water for households is from rainwater collected in containers (37% of households), rainwater collected in tanks (Plate 9.7) (32% of households), water from rivers and creeks (16% of households) and water from shallow wells (8% of households) (Table 9.5). Rainwater containers include drums, pots or other vessels that can be used to collect and store rainwater from a roof. The rainwater is not treated. The longevity depends on the rate of consumption and quantity of storage available for each family. People along the Orokolo coast are the most dependent on water from shallow wells, as they have more of a pronounced dry season, and tanks and other rainwater catchments dry up.

Table 9.5 – Main Source of Drinking Water (% of Households)

Language Group	Piped*	Well	Spring	River or Creek	Tank	Rainwater	Other
Pawaia	1	1	7	28	34	28	0
Ahia	0	0	0	36	43	21	0
Koriki	8	0	3	35	15	40	0
Iare	7	0	0	13	13	65	4
Kaimare	3	0	0	6	39	53	0
Maipua	0	6	0	50	6	38	0
Orokolo	2	24	0	0	47	25	4
Total	**3**	**8**	**2**	**16**	**32**	**37**	**2**

Source: ERIAS Group (2016a). * Water is piped from a nearby spring, creek or well.

Plate 9.7 – Water Tanks in Use at Upaia

Photo: ERIAS Group.

Sixteen percent of respondents who indicated that they relied on a river or creek as their main source of drinking water extracted water from the Purari River, while others extracted water from smaller creeks that flowed into the Purari River. People residing in Ura, Wabo, Subu, Subu 2, Poroi 2, Poroi 3, Upaia, Aiere, Kairu'u, Akoma, Evara, Kaevaria, Kairimai, Aivai, Apiope and Mapaio Fish Camp extract water from the Purari River or its tributaries for drinking. The extent that these people extract water from the Purari River for drinking depends on the availability of and distance to alternative (better) sources. Few people appear to boil water from the Purari River before drinking it.

People in most (76%) of the villages wash in a river or creek, and the remainder use well water.

A total of 88% of villages access their main source of drinking water within a 10-minute walk from the village. The villages that need to walk farther include Kairimai (10 to 20 minutes), Ara'ava (10 to 15 minutes) and Wabo (30 minutes).

Women from 74% of villages indicated that all household members collected water. Women were mostly responsible for collecting water in the other nine villages, i.e., Kairimai, Ara'ava, Poroi 2, Ere, Avavu, Hepere, Huruta, Oru and Aiere.

Sanitation

The most common types of toilets are traditional pit latrines and improved pit latrines. The traditional pit latrine is a hole dug in the ground, generally with a floor made of branches, logs or rough-sawn timber and often with roughly constructed walls and roof. Pit latrines are not universally accepted due to their unfavorable odor; in lowland areas, they are also susceptible to flooding during high tides, which can cause fecal matter being deposited in village areas.

Around 34% of households reported that they did not use a toilet but used the bush, river or sea. Few households in the villages of Harevavo, Iuku, Kapai 2 and Mariki had a toilet. Toilets built over the river (Plate 9.8) are not common in any particular village but are used by some households in Aiere, Akoma, Apiope, Kairu'u, Kapai 2, Maipenairu, Mariki and Upaia.

Plate 9.8 – Toilet Over the River (Ara'ava)

Photo: ERIAS Group.

9.5.4.4 Domestic Waste Management

Tins and batteries are thrown in the bush, sea or river (56%), buried (27%) or burned (6%) by villages. Most villages dispose of paper and plastic items by burning (50%), throwing in the bush, river or sea (27%) or burying (15%). Most food scraps are fed to pigs and chickens, but some are also discarded into the bush, river or sea, buried or burned.

Designated rubbish disposal areas were identified in only 19% of villages.

Poroi 1 demonstrated the best waste management practices. All rubbish was buried in pits around the perimeter of the village, and all residents washed their hands before cooking and eating, and after going to the toilet. It is likely that these good waste and health practices had been acquired and implemented by villagers employed by the previous and current operators of resource projects in the area, specifically InterOil and Total E&P PNG Limited.

9.5.4.5 Communications, Community Facilities and Commercial Services

Approximately 66% of the villages have mobile phone coverage,[18] and 62% of households have one or more mobile phones. Mobile phones are charged using solar power or generators. Some people charge a small fee for others to charge their phones, e.g., 50 toea or PGK1.00 (US$0.15 or US$0.30).[19] Mobile phones are not only owned by people living in villages with mobile phone reception, as some people who live in villages that do not have mobile phone reception will own a phone to use when they travel to Kerema or other locations.

Approximately 33% of households own a radio, 18% own a television, and only 4% own a computer or iPad. Radio therefore remains the main method of receiving news. Twenty five percent of households surveyed had used the internet, and 21% had used social media.

There are no postal services, and the nearest post office is in Kerema. Newspapers are not delivered to villages in the PAOI. Herd Base is the only location that has television regularly. This allows employees to watch news on PNG or Australian broadcasters. The only way to receive news for most of the population is from radio or by internet-based news using mobile phones.

Other than schools and health facilities, the only other community facilities are churches and sports fields. Most villages have a church, often shared by different denominations (see Section 9.5.2). Churches are typically made of traditional materials, with open sides, although some have sheets of iron on the roof (Plate 9.9).

Plate 9.9 – Church with Iron Roof (Ara'ava)

Photo: ERIAS Group.

Most villages also have one or more sports fields or courts. These typically include a sports field for playing soccer and touch rugby, and a basketball or volleyball respectively. The sports fields are basic and generally use local materials for goal posts, posts and backboards (Plate 9.10).

Compared to most provincial capitals in Papua New Guinea, Kerema has relatively few stores and provides little in the way of commercial services (e.g., agricultural inputs, freight services). Most people regard the stores in Kerema as too expensive and prefer to travel further to Port Moresby to make their purchases at lower cost.

18 Mobile phone coverage may not be comprehensively available in all areas across the villages noted; however, it is available from one or more locations either in the villages or close to them.
19 The PGK to US$ currency conversion of PGK100 = US$30 (7 March 2019) is used in this chapter.

Plate 9.10 – Typical Basketball Court (Kilavi)

Photo: ERIAS Group.

9.5.5 Household Wealth

9.5.5.1 Income

The median household income recorded was PGK80 (US$24) per fortnight. This equates to PGK2,080 (US$624) per annum or PGK312 (US$93.60) per annum per capita.

For most people, the main sources of income are the sale of betel nut (see Plate 9.3), fish, crabs, garden produce and sago. Betel nut is the main source of cash income in 14 villages (or 47% of villages surveyed) and was particularly prevalent among Orokolo villages. Sago is the main source of cash income in six villages (or 20% of villages surveyed), particularly for villages in the river transport corridor (i.e., Kairimai, Mapaio and Ikinu) and selected Orokolo villages (i.e., Harevavo, Kaivukavu and Kavava). A total of 48% of all income recorded in the two weeks before the baseline survey was derived from local products.

Wages provide the main source of income for 9% of households, and business activities are the main source for an additional 7% of households (Table 9.6).

Business activities include trade stores (11) and fuel retailers (22). The businesses are relatively small. Many operate on an intermittent basis, e.g., some business opportunities arise on an occasional basis, such as canoe or dinghy hire; and few are formally registered. Table 9.6 shows average annual incomes of small businesses in the PAOI.

Table 9.6 – Business Income

Business Type	Average Annual Income	
	PGK	US$*
Trade stores	12,000	3,600
Fuel sellers	9,000	2,700
Canoe/dinghy hire	29,000	8,700
Chainsaw hire	12,000	3,600
Clothes sales	6,000	1,800
Crocodiles	4,000	1,200
Other	20,000	6,000
Total	**92,000**	**27,600**

Source: ERIAS Group (2016a). *Applying PGK100 = US$29.64.

Income levels varied significantly in the fortnight before the survey. Figure 9.4 shows the distribution of household income. Seventy-five households (21%) recorded no cash income in the previous fortnight, 55% of households earned less than PGK100 (US$30), and 92% of households earned less than PGK1,000 (US$300). Thirty households (8.5%) earned more than PGK1,000 (more than US$300) in the previous two weeks, with the maximum for one household of PGK6,180 (US$1,854).

9.5.5.2 Expenditure

Median household expenditure was PGK76 (US$22.80) per fortnight, which equates to PGK1,976 (US$592.80) per annum or PGK286 (US$85.80) per annum per capita. Most household expenditure was allocated to food, transportation and basic household necessities. Costs to transport goods and passengers to and from PAOI villages are high because of remoteness, lack of transport infrastructure (e.g., no roads) and the challenging natural conditions (e.g., steep inaccessible terrain, high rainfall, and seasonally high winds making sea travel treacherous). The prices of fuel and store goods in the PAOI are high relative to Kerema or Port Moresby because of high transportation costs.

Inland communities indicated that Baimuru was a key destination to procure building materials, bulk store food, cooking items and other kitchen utensils, gardening equipment, clothes, mobile phones and other household items. Baimuru is connected by river and is relatively close compared to Kerema or Port Moresby. Coastal communities indicated a preference to travel to Port Moresby to buy building materials and other goods. Port Moresby offered a wider range of materials and lower prices, compensating for the travel cost.

Costs of Living

The price of store food products varied considerably in the PAOI and is high compared to the cost of the same products in Kerema. For example, one kilogram of rice varied from PGK10 (US$3.00) in Wabo and Poroi to PGK6.50 (US$1.95) at Evara. Tinned fish (180 grams) varied from PGK5.00 (US$1.50) at Wabo and Poroi to PGK3.50 (US$1.05) at Ara'ava. The prices of rice and tinned fish in stores in Port Moresby (PGK5.00 (US$1.50) and PGK2.25 (US$0.67) respectively) and Kerema (PGK6.50 (US$1.95) and PGK3.00 (US$0.90) respectively) are lower and there is also a variety to choose from. Rice averaged around 16% higher than in Kerema and 66% higher than in Port Moresby, while tinned fish averaged 41% higher than in Kerema and 64% higher than in Port Moresby.

The price of various food products sold in the market in Kaivukavu was determined. Although limited produce was weighed in the market at Kaivukavu, the price of freshly caught shark, salmon and catfish was quite similar, ranging from PGK11.90 to PGK13.75 (US$3.57 to US$4.13) per kg. The price of green vegetables was relatively uniform, varying from PGK1.59 (US$0.48) per kg for pumpkin leaves to PGK4.17 (US$1.25) per kg for aibika. The only staples weighed were cooking bananas, which averaged PGK2.04 (US$0.61) per kg, and cassava, which cost PGK2.63 (US$0.78) per kg. The price of chickens is generally around PGK20 (US$6.00), while pigs can cost from PGK70 to PGK500 (US$21 to US$150) depending on size.

Transport Costs

Charter flights from Wabo[20] to Port Moresby cost PGK900 (US$270) one way, while the cost from Wabo to Goroka is PGK400 (US$120) one way.

20 Flights out of Wabo are infrequent. Costs should be considered indicative only.

HOUSEHOLD INCOME DISTRIBUTION, PGK PER FORTNIGHT

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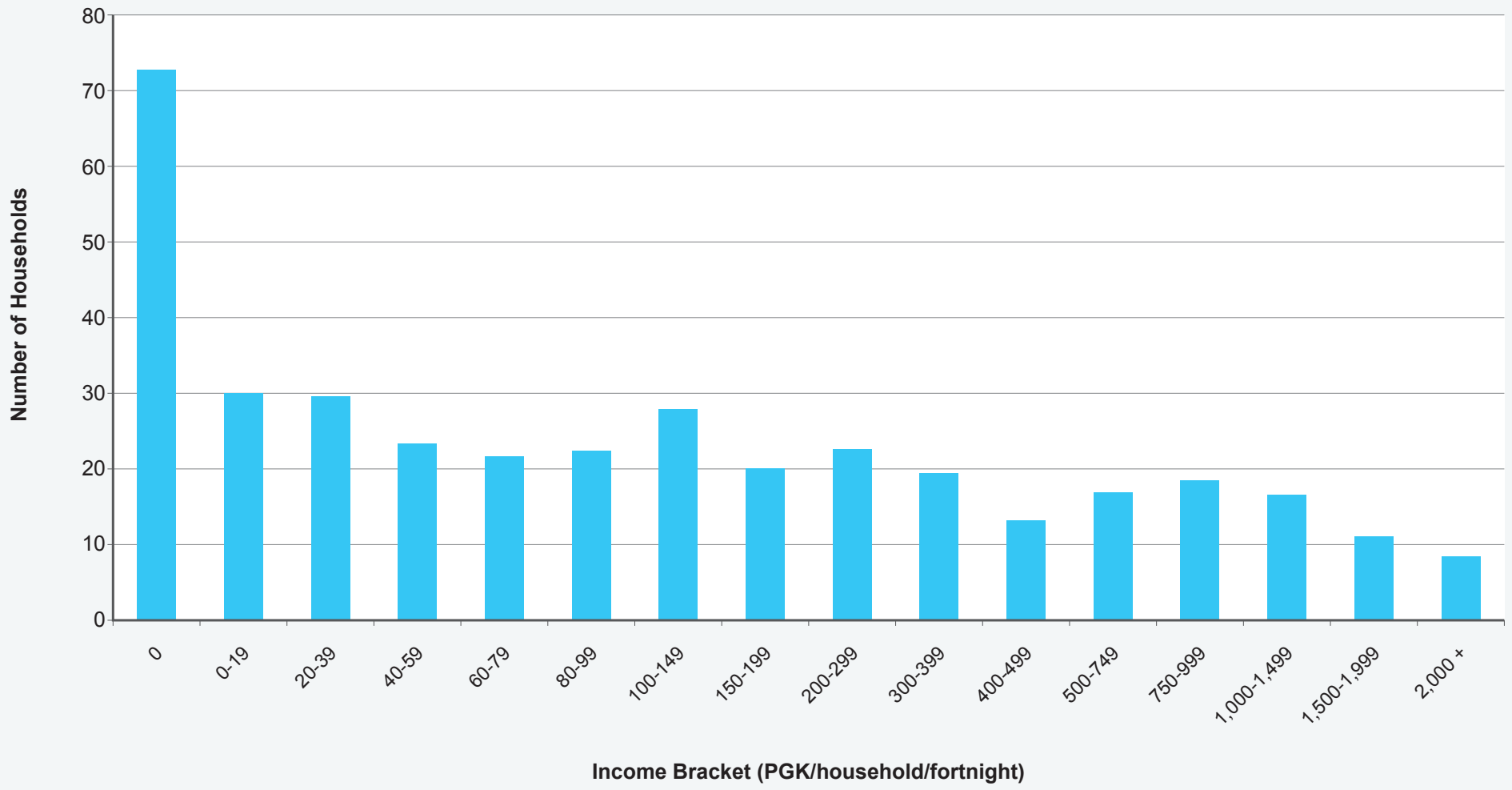
FIGURE 9.4



ERIAS Group | 01215B_23_F9.4_v1

The price of a dinghy fare from the Purari River delta coastal areas to Kerema is about PGK200 (US$60) per passenger, with extra costs for freight. The cost of a public motor vehicle fare from Kerema to Port Moresby is PGK50 (US$15) each way, again with extra charges for freight. The cost to reach Kerema from further up the Purari River is higher.

Outboard motor fuel, commonly referred to as 'zoom', is typically sold at PGK30 (US$9) per gallon in the Orokolo area to PGK40 (US$12) per gallon in more remote parts of the PAOI; however, sellers at both Ura and Wabo claimed to be selling zoom fuel for PGK60 (US$18) per gallon during the baseline surveys.

9.5.5.3 Savings and Banking

Despite the absence of banks and banking agencies in the PAOI, 31% of households surveyed indicated that they or at least one family member had a bank account. Although specific information was not collected on how often bank accounts were accessed, it is likely to be infrequently due to the need to travel considerable distance to access a bank; however, 75% of households indicated that they had access to other cash savings.

Sakura Osura Resources Limited, the Pawaian local business company, previously provided banking services at its store in Wabo. The service has since been suspended. The nearest bank to the PAOI is at Kerema. Some people from Maipenairu used short message service (SMS) banking to obtain cash supplied by the local trade store.

Of the households surveyed, 34% indicated that they had used electronic fund transfer point of sale (EFTPOS) facilities. The Iare, Kaimare, Maipua and Orokolo language groups have a relatively high proportion of households that have used EFTPOS facilities, probably because they are located closer to shops in Kerema and Orokolo with such facilities.

9.5.5.4 Ownership of Assets

Traditionally, key household assets include canoes, clothes and decorative items, axes, knives and other tools required for hunting, fishing, making sago, cooking, making mats and gardening. Some traditional items such as canoes and fishing nets continue to be used, while many others have been replaced.

Very few households own a refrigerator or freezer. Around 25% of households own a sewing machine. Those people owning a refrigerator or freezer generally operate a business and use it to sell cold drinks and ice-blocks. Sewing machines that are not electrical are used to make and repair clothes. Few people have chainsaws or a gun or rifle, instead choosing to use axes to fell trees or cut timber and traditional weapons to hunt. Another factor limiting the ownership of many items is the lack of commercial services, specifically those that could repair a chainsaw or sell shotgun cartridges or bullets.

Walking and using canoes are the traditional forms of transport; 67% of households own canoes, while only 15% of households own a dinghy. Twenty-one percent of households own an outboard motor, which could be attached to either a canoe or dinghy.

None of the communities reported owning motor vehicles or motorbikes, which would be of little benefit given the absence of public roads or tracks in the PAOI.

9.6 Education

9.6.1 Access to Education

The PAOI contains 32 functioning schools; 23 elementary and 9 primary schools[21] (Table 9.7, Plates 9.11 and 9.12). Figure 9.5 shows school locations. The government runs most of the elementary schools, while church agencies run most of the primary schools.

Table 9.7 – Number and Location of Schools in the PAOI

Project Area	Village	Language Group	Elementary Schools*	Primary Schools (Administration)
PRL-15	Poroi 2	Pawaia	✓ Poroi Elementary School	✓ Poroi Primary School (Lutheran Church Agency)
	Poroi 1	Pawaia	-	-
	Poroi 3	Pawaia	-	-
	Wabo	Pawaia	-	-
	Ura/Wabo Station	Pawaia	✓ Wabo Elementary School	✓ Wabo Primary School (Government)
	Subu	Pawaia	-	-
	Subu 2	Pawaia	✓ Subu 2 Elementary School	-
	Mapaio Fish Camp (Settlement)	Iare	-	-
River Transport Corridor	Mapaio	Iare	✓✓ Mapaio Aikavalavi Elementary School and Mapaio Elementary School	✓ Mapaio Primary School (Church, not specified)
	Kaevaria	Iare	-	-
	Aumu	Iare	-	-
	Aivai	Iare	-	-
	Ara'ava	Koriki	✓ Ara'ava Elementary School	✓ Ara'ava Primary School (United Church Missions)
	Kairimai	Koriki	✓ Elementary School	
	Akoma and Kairu'u	Koriki	✓ Elementary School	✓ Akoma Primary (Government)
	Ikinu	Koriki	✓ Ikinu Elementary School	
	Upaia	Kaimare	✓ Upaia Elementary School	-
	Apiope	Maipua	✓ Apiope Elementary School	Primary school under construction and due for completion in 2017
	Evara	Ahia	-	-
Export Pipeline Corridor	Hepere	Orokolo	✓ Hepere Elementary School	-
	Ere and Kilavi	Orokolo	✓ Kilavi Elementary School	-
	Muro Mission	Orokolo	-	✓ Muro Primary School (Catholic Agency)

21 Elementary includes preparatory to Grade 2. Primary includes Grade 3 to Grade 8.

Table 9.7 – Number and Location of Schools in the PAOI (cont'd)

Project Area	Village	Language Group	Elementary Schools*	Primary Schools (Administration)
Export Pipeline Corridor (cont'd)	Avavu	Orokolo	✓ Avavu Elementary School	-
	Huruta	Orokolo	✓ Huruta Elementary School	-
	Paevera	Orokolo	✓ Paevera Elementary School	-
	Harevavo	Orokolo	✓ Harevavo Marea Elementary School	-
	Kaivukavu	Orokolo	✓ Kaivukavu Larihairu Elementary school	✓ Arehava-Harevavo Primary School (Government)
	Larihairu	Orokolo	*see Kaivukavu*	-
	Marea	Orokolo	*see Harevavo*	-
	Iuku	Orokolo	✓ Iuku Elementary School	-
	Mareke	Orokolo	✓ Mareke Elementary School	-
	Kavava	Orokolo	✓ Miri-Muru Elementary School	✓ Orokolo Primary School (United Church Agency)
	Oru, Lariau and Herakela	Orokolo	✓✓ Oru-Lariau Elementary School, Herekela Elementary School	✓ St Anne Primary School (Catholic Church)
Total schools			**23**	**9**

Source: ERIAS Group (2016a).
✓ = School present.
* All elementary schools in the PAOI are government-run.

Plate 9.11 – Elementary Classroom at Subu 2

Plate 9.12 – Primary School Classroom at Oru

Photos: ERIAS Group.

EDUCATIONAL FACILITIES IN THE PAOI

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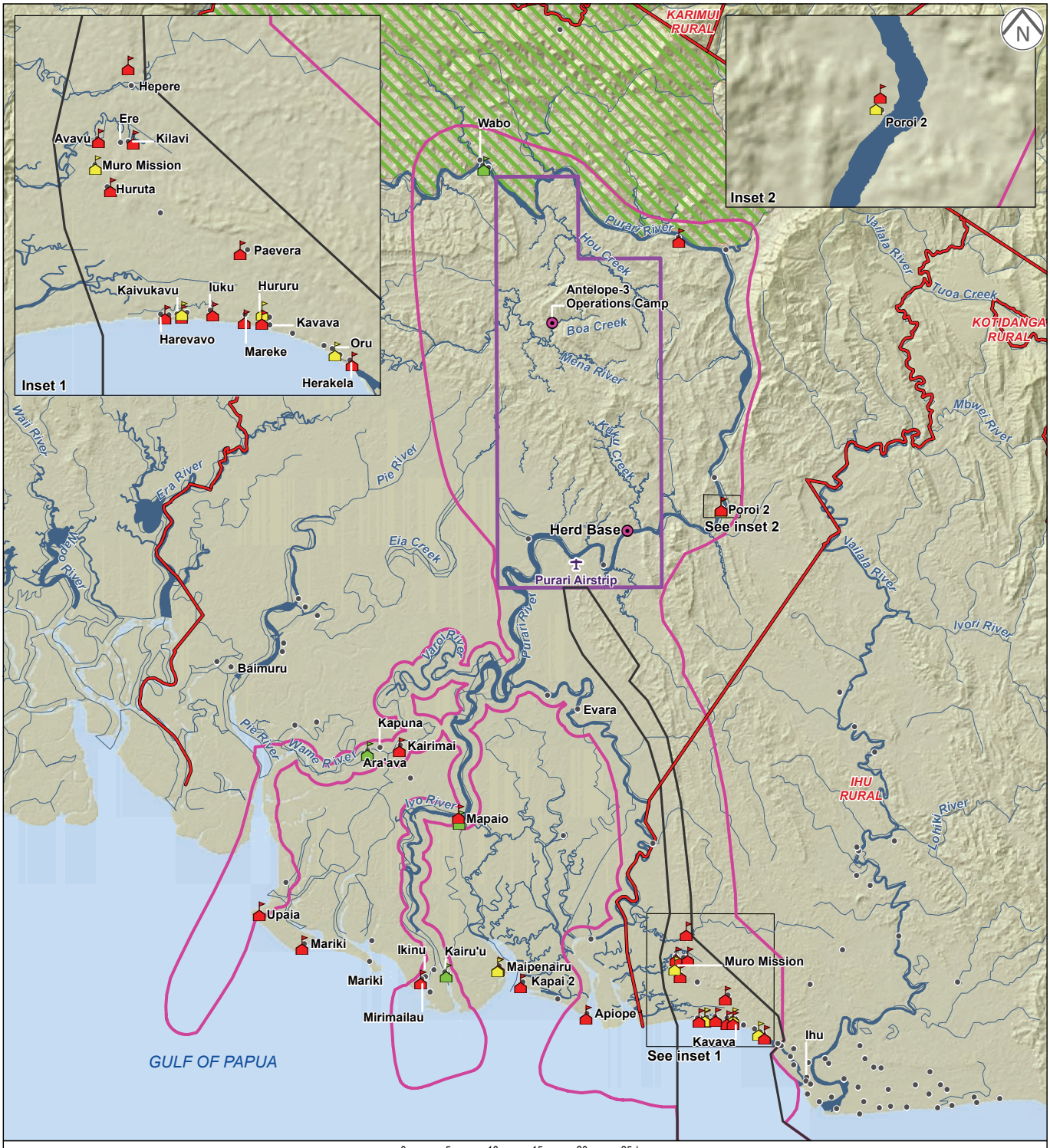
FIGURE 9.5



SCALE: 1:650,000 @ A4

0 5 10 15 20 25 km

COORDINATE SYSTEM: PNG94 PNGMG94 Zone 55

- Town and village
- Base camp
- Airstrip
- Local level government boundary
- Waterway
- Waterbody
- PRL-15
- Export pipeline corridor
- Upstream Project area of influence
- Crater Mountain Wildlife Management Area

Schools

- Elementary
- Elementary and primary
- Primary

Communities outside of the Project area of influence have not been verified. Only government administrative centers and notable locations have been labeled for context.

None of the elementary or primary schools has any boarding facilities, which means that access to school often relies on students staying with relatives in the village containing a school. An average of 57 elementary and 155 primary school students attend schools in the PAOI.[22] Elementary schools have an average of 1.9 teachers per school, and primary schools have an average of 4.6 primary teachers per school. Elementary schools offer an average of 2.4 grades, while primary schools offer an average of 5.3 grades. Elementary schools have an average of 38 students per teacher, and primary schools have an average of 37 students per teacher. There are teacher vacancies at most elementary and primary schools, indicating the difficulty for these rural schools of attracting and retaining teachers (ERIAS Group, 2016a).

The PAOI does not contain any secondary or vocational schools. The nearest secondary schools are at Ihu, Araimiri, Kerema and Kikori. Some students from Pawaia villages also attend secondary school in Kundiawa (Simbu Province) and Goroka (East Highlands Province). The nearest vocational schools are at Baimuru and at Araimiri, which is officially a technical secondary school, run by Don Bosco, with a focus on practical courses. A vocational school at Ihu has been closed for many years and is in a state of disrepair.

The total number of students in the schools surveyed is shown in Table 9.8. There are 116 male students per 100 female students in the PAOI.

Table 9.8 – Students in the PAOI

Grade	Male	Female	Total
Preparatory	190	189	379
Grade 1	167	150	317
Grade 2	228	170	398
Grade 3	163	129	292
Grade 4	148	136	284
Grade 5	146	137	283
Grade 6	128	87	215
Grade 7	97	92	189
Grade 8	65	62	127
Total	**1,332**	**1,152**	**2,484**

Source: ERIAS Group (2016a).

Extrapolating demographic data from the household surveys shows the gross enrolment ratio is 89% for boys and 87% for girls across the PAOI. This indicates mostly equal participation rates by boys and girls, and further highlights that at least 12% of the school-aged population is not attending school. Furthermore, given the late age that many children commence their education and the relatively older age of students relative to the grade they are attending, the net enrolment ratio is likely to be much lower and would indicate that more than 12% of the school-aged population does not attend school.

Results from the household survey indicate that just 31% of boys and girls aged from six to 15 years attend school. Many children attending school are older than the age recommended by the Department of Education. A net enrolment ratio of 31% in the PAOI compares poorly with Department of Education estimates for Papua New Guinea (53%) and Gulf Province (42%) for 2007.

22 Based on data collected for 20 elementary schools and 8 primary schools in the PAOI.

9.6.2 Education Levels and Literacy

Ten percent of males and 21% of females aged 16 years and above in the PAOI have never attended school, compared with an estimated 8% of males and 11% of females in Gulf Province. More than half of the females from Pawaia villages aged 16 years and above have never attended school.

Approximately half of all males and females aged 16 years and above across the PAOI have completed between Grade 1 and Grade 6. Approximately 32% of males aged 16 years and above have completed between Grade 7 and Grade 10, compared to only 24% of females of the same age category. Very few males or females from the PAOI have completed vocational or technical schooling or attended university.

A self-assessment of literacy conducted during the household survey showed that 19% of males and 33% of females aged 16 years and above cannot read or write in any language (Table 9.9). Individuals were asked whether they could read or write, but this was not validated by any testing. This is a better result than the census data for Papua New Guinea and Gulf Province from 2000;[23] however, a detailed assessment of literacy levels in Gulf Province revealed that the literacy levels stated by people were much higher than actual levels evidenced by a simple literacy assessment. The literacy levels reported during the household survey are likely to have been overstated.

Table 9.9 – Literacy Level in the PAOI (Age 16 and Above)

Language Group	Sample Size	Read and Write (%)	Read Only (%)	Illiterate (%)
Pawaia - males	178	69	6	25
Pawaia - females	121	28	6	66
Ahia - males	23	39	13	48
Ahia - females	21	19	24	57
Koriki - males	112	83	2	15
Koriki -females	108	71	6	23
Iare - males	136	87	4	9
Iare - females	134	77	5	19
Kaimare - males	30	87	0	13
Kaimare - females	41	59	5	37
Maipua - males	37	81	0	19
Maipua - females	34	74	0	27
Orokolo - males	243	77	5	19
Orokolo - females	253	71	3	27
Total - males/Average %	**759**	**77**	**4**	**19**
Total - females/Average %	**712**	**63**	**5**	**33**

Source: ERIAS Group (2016b).

9.7 Community Health and Safety

9.7.1 Access to Healthcare

The PAOI contains nine operating and three partially operating healthcare facilities. The location of healthcare facilities is shown in Figure 9.6 and listed in Table 9.10.

23 Papua New Guinea - 39% of males and 49% of females were classified as illiterate. Gulf Province – 49% of males and 69% of females were classified as illiterate.

HEALTH FACILITIES IN THE PAOI

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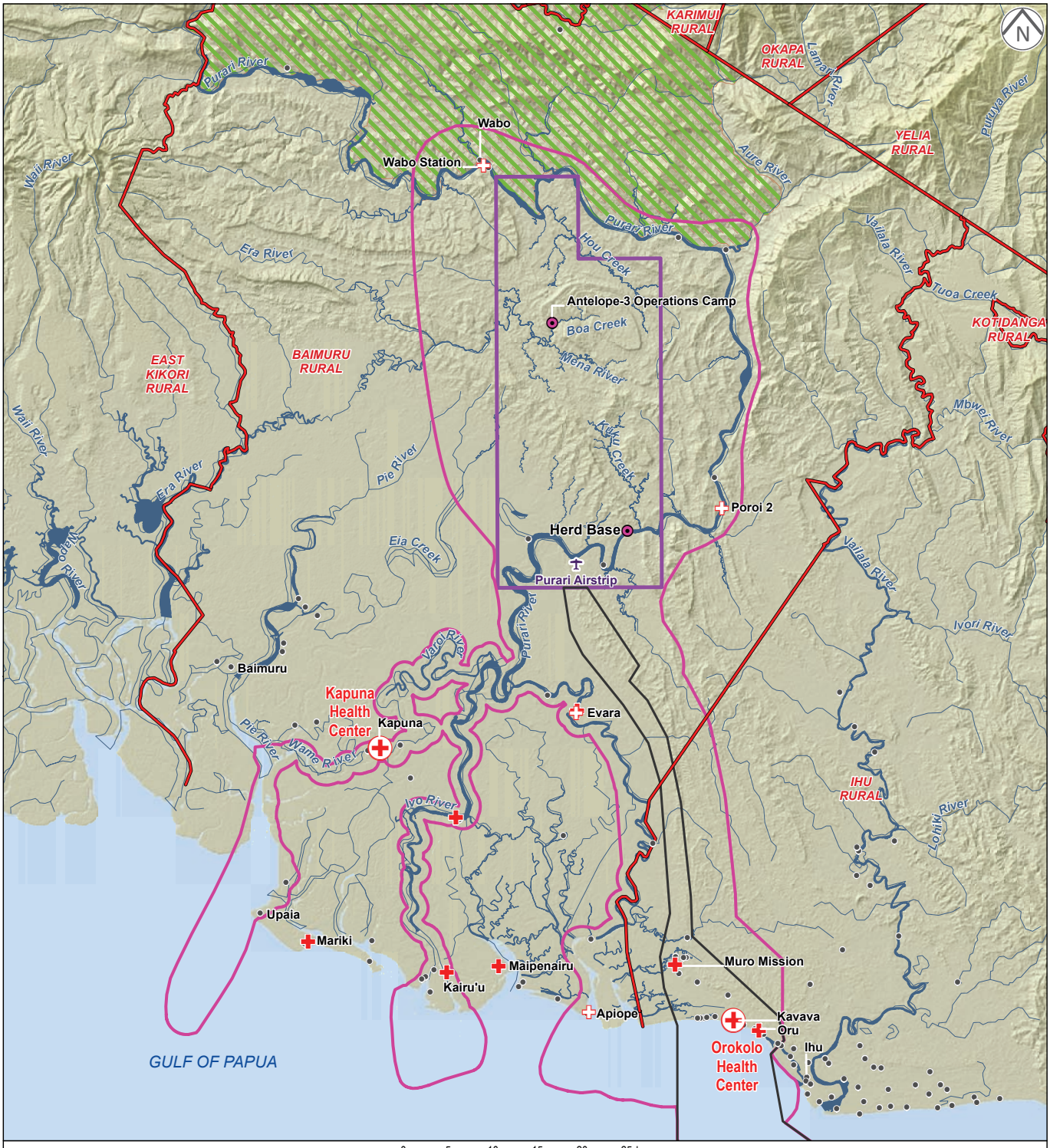
FIGURE 9.6



Communities outside of the Project area of influence have not been verified. Only government administrative centers and notable locations have been labeled for context.

Table 9.10 – Healthcare Facilities in the PAOI

Village	Health Facility	Operational Status	Staffing#	Sponsor	Facility
Akoma-Kairu'u	Aid Post	Operating	CHW	United Health Services	Building present with a water supply and a toilet. No electricity or radio.
Apiope	Aid Post	Partially operating	CHW	United Health Services	No building. CHW works from a house. No electricity, water, toilet or radio.
Ere-Kilavi	Aid Post	Operating	2 x CHWs	Catholic Health Services	Building is inadequate. No electricity, water, toilet or radio.
Evara	Aid Post	Partially operating	CHW* HEO (TEP PNG)	Government	Building is present but needs repair. Solar light, water and toilet but no radio.
Kavava	Orokolo Sub-health Center	Operating	7 x CHWs	United Health Services	Building is inadequate. Has water and toilet but no electricity or radio.
Kapuna	Kapuna Health Center	Operating	2 x Doctor 4 x Nurse 25 x CHWs	Gulf Christian Services	Building is present but needs repair. Has electricity, water, toilet, radio and refrigerator.
Maipenairu	Aid Post	Operating	2 x CHWs	United Health Services	Building is present but no electricity, water, toilet or radio.
Mapaio	Aid Post	Operating	2 x CHWs	United Health Services	Building is present but is unfinished and not used. No electricity, water, toilet or radio.
Mariki	Aid Post	Operating	CHW	United Health Services	Building needs repair. No electricity, water, toilet or radio.
Oru-Lariau-Herakela	Aid Post	Operating	CHW	Catholic Health Services	Building needs repair. Has water and a toilet but no electricity or radio.
Poroi 2	Aid Post	Partially operating	HEO (TEP PNG)	TEP PNG	Building needs repair. No electricity, water, toilet or radio.
Wabo	Aid Post	Operating	2 x CHWs HEO (TEP PNG)	Government	Building is present but needs repair. Has water, a toilet and electricity (connected to TEP PNG office).

CHW – Community Health Worker, HEO – Health Extension Officer.
* CHW not regularly present.

As shown in Table 9.10, the healthcare facilities have very basic amenities and are often not consistently staffed or functional. Only the Kapuna Health Center has electricity (except for a solar light at Evara), an operating refrigerator in which to store medicines, a boat and a radio. Over half of the health facilities do not have a water supply or toilet facilities. The Kapuna Health Center (Plate 9.13) is the only facility staffed with doctors.

Plate 9.13 – Kapuna Health Center

Photo: ERIAS Group.

Healthcare facilities are usually reached by motorized canoe or dinghy or by walking. It can take days to reach a healthcare facility for some villages in the PAOI. Two to three days are required to walk, or a combination of canoe and walking, from Aivai, sometimes via Aumu, to the Orokolo Sub-health Center or the Kapuna Health Center. To travel to the Kapuna Health Center requires two days of travel by paddle canoe from Kaevaria (via Mapaio), from Kapai 2 or from Upaia. Other villages can access health care in less than one day's travel by walking, paddle canoe, motor dinghy or a combination thereof. Often a village will have multiple locations at which its villagers will seek health care, as the operating or partially operating aid post may not be staffed when visited, requiring the villager to travel to another location (Part 16 of Volume 2).

9.7.2 Food Security and Nutrition

A diverse range of protein sources (e.g., red meat, fish, crustaceans, shellfish and invertebrates) with varied nutritional values is available across the PAOI (Section 9.8). Animal foods obtained by hunting and collecting are most important among the river transport corridor and inland villages; They are less important in the villages close to the mangroves or the coast. In the latter, crustaceans (e.g., crabs), shellfish and mangrove worms provide a large proportion of the animal food intake. Many villages have a perception that high-value animal resources, such as cassowaries and wild pigs, are locally depleted due to disturbance, usually attributed to logging and overhunting.

Communities in the PAOI perceived that adequate quantities of food were available for most people, most of the time, under normal environmental conditions. Food security could be threatened during significant flooding and drought (e.g., El Niño events), but generally there was considered enough to eat. The availability of certain plant and animal foods is, in many cases, seasonal; however, generally when one item is not available, another is; and most communities always have access to sago and coconuts (famine foods).

Anthropometric measurements to assess body size and composition were not conducted as part of the baseline characterization; however, data from two previous anthropometric studies conducted in the PAOI was analyzed. Between 1995 and 1997, Ulijaszek (2003) performed an analysis of mean height, weight and body mass index (BMI) of 292 adults in three villages in the Purari River delta (i.e., Koravake, Mapaio and Ara'ava); and in 2012, the previous operator of PRL-15, InterOil, sponsored a health survey of 853 people from eight Pawaia villages. Both

studies found that most men and women in the PAOI have a BMI in the healthy range (Table 9.11).

Table 9.11 – Key Findings of Previous Anthropometric Studies in the PAOI

Ulijaszek (2003)	2012 InterOil Study
♦ 23% of males and 24% of females had a BMI* greater than 25. ♦ 1% of males and 6% of females had a BMI greater than 30. ♦ 13% of females had a BMI below 18.5 compared with 5% of males. ♦ Mean height of younger adults was greater than that of older adults. ♦ Female weights were positively associated with income and the number of years of education. ♦ BMI was positively associated with income and having urban relatives but not with urban dwelling per se.	♦ Most women (64%) and 47% of men had normal BMIs. ♦ Slightly more women (3%) than men (2%) recorded a BMI in the less than 18.5 BMI range. ♦ A greater proportion of men (47%) than women (27%) were overweight. ♦ For the obese category (i.e., BMI greater than 30), more women were obese (6%) than men (4%).

Source: Part 16 of Volume 2.
* A BMI below 18.5 is considered underweight; a BMI of 18.5 to 24.9 is considered healthy; a BMI of 25 to 29.9 is considered overweight; a BMI of 30 or higher is considered obese.

In addition to anthropometric measurements, the InterOil study measured hemoglobin in adults and children to determine levels of anemia. The study indicated a relatively high prevalence of mild to moderate anemia in children below the age of five and, to a lesser extent, in women aged 15 to 49 years. The study also showed high levels of intestinal parasitemia (e.g., ascaris and hookworm), which were thought to be a significant driver of the mild to moderate anemia.

Overall, both the community and household survey data and the results of previous studies indicate that food security and nutrition are not significant problems across the PAOI.

9.7.3 Maternal and Child Health

Across Papua New Guinea, maternal mortality is high, with obstetric hemorrhage, sepsis and eclampsia the main causes of maternal death. Less than half of all births occur in a hospital or health center; although, most women receive some antenatal care from a skilled health worker (UNDP, 2014).

In the PAOI, approximately 85% of mothers attend at least one antenatal clinic during pregnancy, either at an aid post, health center or mobile patrol; however, most do not travel to a health center to give birth. This attendance level is significantly better than the 2015 overall Gulf Province level of 54% (NDOH, 2015). Only 35% of the villages have trained village birth attendants; however, 94% of villages have a traditional birth attendant. A village birth attendant has formal training in delivery and management of complications, while a traditional birth attendant does not have this training.

Approximately 46% of children in the PAOI are born at a health center. The remaining 54% of children are born at an aid post, at home or in the bush for a range of reasons, including the excessive distance and cost of traveling to a health center or cultural preference. Of the children born at a health center, the Kapuna Health Center has the most deliveries (45%) followed by the Orokolo Sub-health Center (35%). Most women travel by canoe (61%) or walk (39%) to these centers. Fifty percent of women have a travel time greater than four hours to deliver their baby, including 18% who reported having to travel for more than one day.

9.7.4 Communicable Respiratory Diseases

Communicable respiratory diseases in the PAOI include lower respiratory tract illness such as bacterial and viral pneumonia, tuberculosis (TB), measles and chicken pox. Respiratory diseases are the leading cause of reported illness in the PAOI and are exacerbated by:

- High household occupancy and many children. The average household size in the PAOI is 6.7 compared to the national average of 5.3, and the PAOI has a large 0 to 9 years age population. Children under the age of 5 years in a household, bedroom sharing and high household occupancy are all significant risk factors for acute lower respiratory infections and pneumonia (Baker et al., 2013).
- Cooking or heating with wood as a primary source. One hundred percent of households use wood as the main cooking source and cook indoors. Indoor cooking with wood is a known risk factor for respiratory illness, particularly for children under age five (Ezzati & Kammen, 2002).
- Betel nut chewing. Betel nut is widely used in the PAOI. Betel nut chewing is associated with an increased rate of respiratory illness, particularly asthma (Garg et al., 2014) and could spread TB spread (Cross et al., 2014).
- Low immunization levels. Community immunization levels in the PAOI are low; e.g., immunization against measles is significantly lower in Gulf Province (19%) than the national level (40%) (NDOH, 2015).
- Poor hand washing practices.

The outpatient and inpatient data from the Kapuna and Kerema[24] health centers demonstrates the high burden of respiratory disease in the PAOI (Table 9.12).

Table 9.12 – Outpatient and Inpatient Data 2014 to 2015 (%)

Health Center	Other	Respiratory	Skin	Gastro-intestinal	Accident and Injury	Eye and Ear	Malaria	Anemia
Outpatient								
Kapuna	55	16	11	5	4	4	3	<1
Kerema	31	32	10	6	9	5	3	<1
Inpatient								
Kapuna	48	15	13	9	7	6	2	-
Kerema	72	13	10	<1	1	<1	1	-

Source: Part 16 of Volume 2. < = less than.

The community and household surveys indicate that malaria is the most common illness in households in the PAOI; however, at a community level in developing countries, it is common for respiratory symptoms to be conflated with malarial symptoms and that reports of cough or fever (without diarrhea) are more likely to be respiratory related rather than due to malaria (D'Acremont et al., 2010).

Tuberculosis

Tuberculosis (TB) is a communicable, airborne infection caused by the bacterial species *Mycobacterium tuberculosis*. It can lie dormant in the body for many years; however, for immuno-compromised individuals, including those with human immunodeficiency virus (HIV) or diabetes, TB can develop into a disease that destroys organ tissue, most commonly in the lungs. The most common symptoms of TB are a persistent cough and fever.

24 Although Kerema is outside the PAOI, the Kerema health center has been included in characterisation of community health given it is near the PAOI. People from the PAOI, especially coastal communities, may at times use this facility.

Tuberculosis is a significant issue in Papua New Guinea and is at epidemic levels in some locations, including Gulf Province (Cross et al., 2014). In a study undertaken in 2012, the estimated incidence of TB in the Kikori District was 1,290 per 100,000 people, which is almost four times higher than the PNG national rate reported to the World Health Organization (WHO) (Cross et al., 2014) (Table 9.13).

Table 9.13 – Comparative Tuberculosis Incidence Rates

Country	Per 100,000
South Africa	981.0
Papua New Guinea	303.0
China	80.0
Australia	6.3

Source: Cross et al. (2014).

Health professionals are increasingly concerned about the prevalence of TB in Papua New Guinea and the rise of drug-resistant strains of TB (i.e., MDR-TB and XDR-TB), which are difficult to treat and have a very poor prognosis. International organizations that deliver or support TB programs in Papua New Guinea include:

- The Global Fund to fight AIDS, TB and malaria: The Global Fund is a financing mechanism and not an implementation agency. Since 2004, the Global Fund has approved grants for Papua New Guinea worth approximately US$270 million (PGK910 million). The Government of Papua New Guinea's investment in Global Fund supported programs is also significant, with an estimated budget of US$110 million (PGK371 million) from 2015 to 2017.
- Australian Government: Australia allocated AU$60 million (PGK143 million)[25] toward TB programs from 2011 to 2017. Australia's support is implemented by such partners as the PNG National Department of Health (NDOH), the World Health Organization (WHO), World Vision, the Burnet Institute, Global Fund and Médecins Sans Frontières (MSF).
- The World Health Organization: WHO provides internationally recognized technical and policy oversight to the TB interventions of all partners in Papua New Guinea.
- World Bank Group: The World Bank Group has provided US$15 million (PGK51 million) for programs in the Western Province and National Capital District.
- US Agency for International Development (USAID): USAID announced a program in 2016 to provide targeted technical assistance to help detect and treat MDR-TB and XDR-TB.
- Médecins Sans Frontières TB Program Assistance: MSF runs a comprehensive TB diagnostic and treatment management program out of the Kerema Health Center. MSF's role is to support and work closely with the National TB Program of the NDOH.

Tuberculosis is the most significant infectious disease in the Gulf Province, and the Kapuna and Kerema health centers have documented many cases. In 2016, the case notification rate was recorded as 767 per 100,000, more than double the national level (Gulf Provincial Health Office, 2016). During the household survey, 58 individuals (27 males and 31 females) reported three or more symptoms associated with active TB; however, it is unknown what percentage (if any) of these individuals has active TB, as neither testing nor clinical evaluation was undertaken as part of the household survey.

25 The AU$ to PGK currency conversion of AU$100 = PGK238 (7 March 2019) was used.

Factors contributing to the high incidence of TB in Gulf Province most likely include delayed presentation and difficulties in managing patient follow-up. The late presentation of cases and inefficient treatment access and delivery may contribute to a prolonged transmission risk and very high infectious burdens of TB.

9.7.5 Vector-borne Diseases

Vector-borne diseases are infections transmitted by an insect bite, most commonly the mosquito. The dominant vector-borne disease in Papua New Guinea and the PAOI is malaria; however, other vector-borne diseases include lymphatic filariasis, the flaviviruses (e.g., dengue, Japanese encephalitis, Zika and chikungunya) and alphaviruses (e.g., Ross River fever). In addition, Burkitt lymphoma, an important adolescent malignancy caused by Epstein-Barr virus, is strongly associated with areas of malaria transmission (Moorman & Bailey, 2016; Lavu et al., 2005) and is well documented in the Gulf Province.

Two important malaria surveys were conducted in the Gulf Province in the past five years:

- PNG Institute of Medical Research (IMR) in 2014: 504 children from Gulf Province aged from 5 to 59 months were tested for the malaria parasites.
- InterOil in 2012: 366 people across all ages from eight Pawaia villages were tested for malaria using a rapid diagnostic test. A follow up study with 175 people was conducted using both rapid testing and slide microscopy.

The PNG IMR study indicated a prevalence rate of 0.02%, lower than the national results for children aged from 5 to 59 months (3%). The InterOil studies (Cross et al., 2014) also showed a very low (less than 1%) prevalence of malaria.

Community surveys documented malaria as a notable health problem in communities and households in the PAOI; however, as outlined in Section 9.7.4, it is not uncommon for general respiratory symptoms to be conflated with malarial symptoms.

Little is known about the prevalence of other vector-borne diseases in the PAOI; however, literature reviews of lymphatic filariasis indicate that the disease affects the Kerema and Kikori districts (Graves et al., 2013).

Nearly all households report owning bed nets (i.e., 50% report owning between three and six nets), and use is high. Mothers and children are usually prioritized when there is not a net for each household member.

9.7.6 Sexually Transmitted Infections

Papua New Guinea has among the highest prevalence of HIV, syphilis, and other sexually transmitted infections (STIs) in the Asia-Pacific region (Vallely et al., 2010, 2016). Adult HIV prevalence is currently estimated at 0.9%; however, prevalence of 12 to 17% has been reported among women and men who sell or exchange sex, and antenatal HIV prevalence of around 2% has been reported from several highland provinces. Papua New Guinea is among 12 high-burden countries selected by the WHO for intensified support to eliminate mother to child syphilis transmission. Papua New Guinea also has one of the highest estimated burdens of cervical cancer globally, with an age-standardized incidence of 23.7 per 100,000, compared to 5.0 per 100,000 in Australia. Cervical cancer is considered an STI caused by specific strains of the human papillomavirus (HPV) (CDCP, 2017).

While overall STI data across the PAOI is sparse, there is consistent data for HIV from antenatal and outpatient clinics for the Kapuna health center (0.4% rate). Outside of, but near the PAOI, there is also data for the Kerema health center (less than 0.5%). This health center data is

consistent with national HIV data for rural locations (less than 1% prevalence rate), although it is likely to under-represent the actual STIs in the PAOI due to the cultural stigma associated with STI diagnosis.

9.7.7 Accidents and Injuries

Injuries are estimated to cause more than five million deaths each year in developing countries, which is roughly equal to the number of deaths from HIV/AIDS, malaria and TB combined (Gosselin et al., 2009).

More than 90% of injury deaths occur in low- and middle-income countries, where preventive efforts are often nonexistent and health care systems are least prepared to meet the challenge, as is the case in Gulf Province and Papua New Guinea more broadly. Injuries contribute to the cycle of poverty and impact individuals, communities, and societies. Injuries have many dimensions: human (e.g., victim, caregiver), environment (e.g., infrastructure, legislation) and vector (e.g., motor, marine and river vehicles for injuries; weapons for violence open fires for burns). The documented outpatient burden of accidents and injuries in PAOI and in nearby Kerema is similar (i.e., Kapuna Health Center) or higher (i.e., Kerema Health Center and Orokolo Sub-health Center) than the Gulf Province 2015 rate of 4.9% (compared with the national rate of 3.6%). Outpatient data shows:

- Kapuna Health Center: 4% of total caseload.
- Kerema Health Center: 8.6% of total caseload.
- Orokolo Sub-health Center: 8% of total caseload.

Data from aid posts is generally consistent with the health center percentages of 2 to 10%. Some facilities show an artificially higher percentage due to the caseload denominator being small. Nevertheless, provincial data from 2011 to 2015 shows a 27% worsening of injury presentations to health facilities in Gulf Province (NDOH, 2015).

The types of injuries and accidents noted or observed during social field surveys included:

- Wounds (e.g., lacerations, bruises, incisions, crush wounds).
- Burns and scalds.
- Fractures and sprains.
- Snakebite.
- Insect and animal bites.
- Drowning.
- Assault injuries.
- Sexual injuries.

Women also reported that laborious tasks, such as beating sago and working gardens, contributed to muscular-skeletal injuries and general aches and pains.

Gulf Province has minimal emergency services, and less than 3% of health centers have an ambulance (Howes et al., 2014). None of the PAOI villages has any emergency response services.

9.7.8 Alcohol and Drug Dependency

Information from the community-level survey on the consumption of alcohol, marijuana and harder drugs, such as heroin, cocaine, amphetamine and ecstasy, in the PAOI indicates:

- Male alcohol consumption is common. Alcohol consumption is much lower for females.
- Home brew is made and consumed locally, while other alcohol is brought in from Port Moresby or other urban areas. There are no alcohol off-license premises in the PAOI.
- Alcohol abuse is regarded as a law and order problem, particularly as it is associated with various activities that communities consider to be illegal, including fighting, domestic violence, and obscene or abusive language.
- Most communities contain males who smoke marijuana. Village leaders and the women interviewed indicated that the use of marijuana is common and widespread, particularly among young males. Relatively few females reported smoking marijuana.

9.7.9 Domestic Violence

Domestic violence and sexual assault are pervasive problems in the PAOI. Women from every village reported a past incident of domestic violence either from their husband or another family member. In addition, sexual assault was reported as a problem in 22% of the villages surveyed.

Women from 12 villages (40% of villages) indicated an assault had occurred in the past two weeks (Table 9.14). Over the past 12 months, women from 26 villages (87%) indicated an assault had occurred, compared with 67% of women nationally who are believed to have been the victims of domestic violence (Amnesty International, 2010).

Table 9.14 – Last Time a Woman was Assaulted (No. of Villages)

Language Group	Total Number of Villages*	Last 2 Weeks	<1 Year	>1 Year
Pawaia	4	2	1	1
Ahia	1	1	0	0
Koriki	4	1	3	0
Iare	5	0	2	3
Kaimare	2	1	1	0
Maipua	1	0	1	0
Orokolo	13	7	6	0
Total	**30**	**12**	**14**	**4**

* Indicates the total number of villages for which a response to this question was provided. < = less than; > = more than.

9.7.10 Community Safety

Aspects of community safety are included in the Sections 9.7.1 to 9.7.9 and in Sections 9.9 and 9.10. Specifically:

- A community's sense of safety was reasonably high in the PAOI (Section 9.9.3). Most village leaders and women's groups indicated that it was safe in their village.
- A community's perceptions of whether its safety had changed over time indicated that, generally, the sense of safety had either stayed the same or improved, which is attributed primarily to the reintroduction and strengthening of the village court system in most of the PAOI.
- The main safety concerns expressed by the village leaders were sorcery and naturally occurring safety risks such as snakes, crocodiles, and floods. Women's groups indicated that they were not safe because of sorcery and because of social or cultural norms that put them at risk of domestic violence, sexual assault or other forms of violence (Section 9.9.3).
- Accidents and injuries contribute a significant morbidity burden in the PAOI, as outlined in Section 9.7.7.

- The PAOI has no operable roads; thus, it has no incidence of motor vehicle accidents or injuries caused to passengers or pedestrians from motor vehicles.
- Community members travel in small watercraft, predominantly dugout canoes but also dinghies, alongshore of Orokolo Bay and along the three Purari River distributaries and smaller riverways. Such travel constitutes risks to an individual's safety such as drowning, and exposure to water-borne parasites and dangerous animals (e.g., crocodiles and snakes during embarking and disembarking). Community-level surveys indicated that some villagers were concerned about the safety of dugout canoes passing larger vessels that cause bow waves or propeller wash that could inundate canoes and cause them to capsize (Part 22 of Volume 2).
- Violence is a factor jeopardizing community safety and can occur within clans and communities, and between different communities, sometimes in relation to land disputes, or in retribution for perceived grievances. Village leaders, women and youth groups cited 'fighting' as the most or one of the most significant law and order issues (Section 9.9.2 and Part 14 of Volume 2).
- Gender-based violence jeopardizes community safety, with domestic violence and sexual assault prominent (see Section 9.7.9).
- No community emergency medical response is available in the PAOI.

9.8 Livelihoods and Natural Resource Use

9.8.1 Ecological Zones

Ecological zones were used to characterize the heterogeneity of natural resource uses in the PAOI. Each zone only partly overlaps the PAOI; however, the ecological zones provide a guide to the natural environment around each of the surveyed villages. As described in Section 9.2.1, the environmental setting influences people's day-to-day activities. Ecological zones influence how different clans and villages behave similarly in their day-to-day physical activities (see Figure 9.2).

9.8.2 Land and Natural Resource Setting

The land-based portion of the PAOI covers approximately 269,393 ha of the Purari River catchment and encompasses a wide variety of land resources (e.g., vegetation types) and freshwater ecosystems, which both contribute to provisioning ecosystem services. Forests (78%) are the dominant land use area in the PAOI followed by wild stands of sago (9%) and mangroves (7%). The remainder comprises grassland and herb land, and areas dominated by anthropogenic land use (e.g., villages, subsistence agriculture, abandoned coconut plantations and planted sago). The water-based portion of the PAOI incorporates rivers and waterbodies, such as lakes and lagoons, and the ocean. A breakdown of the dominant natural resource land use categories in the PAOI is provided in Figure 9.7 and Table 9.15.

NATURAL RESOURCES IN THE PAOI

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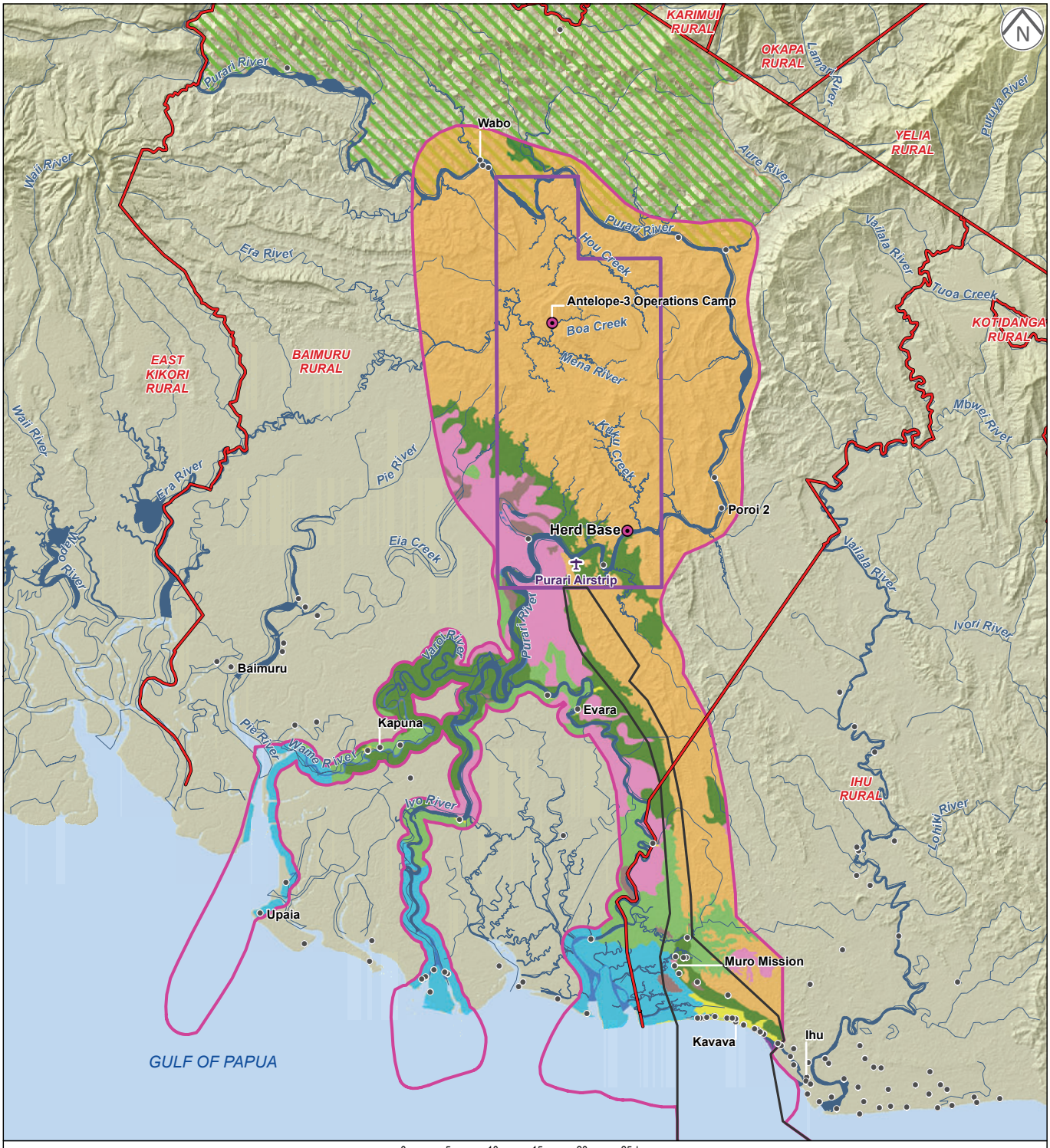
FIGURE 9.7



Communities outside of the Project area of influence have not been verified. Only government administrative centers and notable locations have been labeled for context.

Table 9.15 – Dominant Natural Resource Land Use Categories in the PAOI

Resource*	Area (ha)	%
Forest		
Hill forest	159,483	59
Alluvial forest	32,477	12
Swamp forest	18,979	7
Littoral forest	97	<1
Sub-total	*211,037*	*78*
Other		
Wild stands of sago woodland#	25,332	9
Mangrove	18,453	7
Grassland/herbland	3,164	1
Subsistence land use and villages	1,729	1
Rivers and waterbodies	9,679	4
Subtotal	*58,357*	*22*
Ocean†	**231,589**	
Total (forest and other (excluding ocean))	**269,393**	**100**

* Resource categories and areas are derived from the floristic information management system (FIMS) mapping units based on vegetation mapping terminology and are coded for resource type.
# Wild stands of sago woodland are those dominated by sago rather than being a component of other vegetation types. These are termed Swamp woodland under the vegetation mapping terminology.
† The Ocean portion of the PAOI covers the area from the Purari River delta to Caution Bay.

9.8.3 Land Tenure

Most land in Papua New Guinea is under customary ownership as described in Section 9.2.3.

The usual approach to commercializing land in Papua New Guinea, without alienation, is leasing from the customary owners. This process involves forming an incorporated land group to represent the interests of the landowners, make commercial agreements with developers and manage any income generated.

Existing leases in the PAOI include:

- Forestry leases: Frontier Holdings Limited is currently logging Vailala Blk 3 southeast of the Purari River, and Turama Forest Industries has a forest management agreement for Baimuru Blk 3, which lies northwest of the Purari River and covers all of PRL-15. Further information about forestry activities is provided in Section 7.7 and Section 9.4.1. Logging concessions are shown in Figure 7.24.
- Mining and petroleum leases: The PAOI overlaps three petroleum prospecting licenses and eight mining exploration licenses.
- Special Purpose Agricultural and Business Lease (SABL): In 2010, 656,034 ha of land in Gulf Province was granted to the Purari Development Association for agreed agricultural or other business activity (Figure 9.8); however, the process under which this SABL was granted is under investigation for not aligning with the formal process (Numapo, 2013).

The land dispute and resolution process is outlined in Section 9.9.

9.8.4 Agriculture

Subsistence agriculture dominates in the PAOI and consists of swidden agriculture, sago cultivation, and planted fruit and nut trees or palms.

PURARI SPECIAL PURPOSE AGRICULTURAL BUSINESS LEASE

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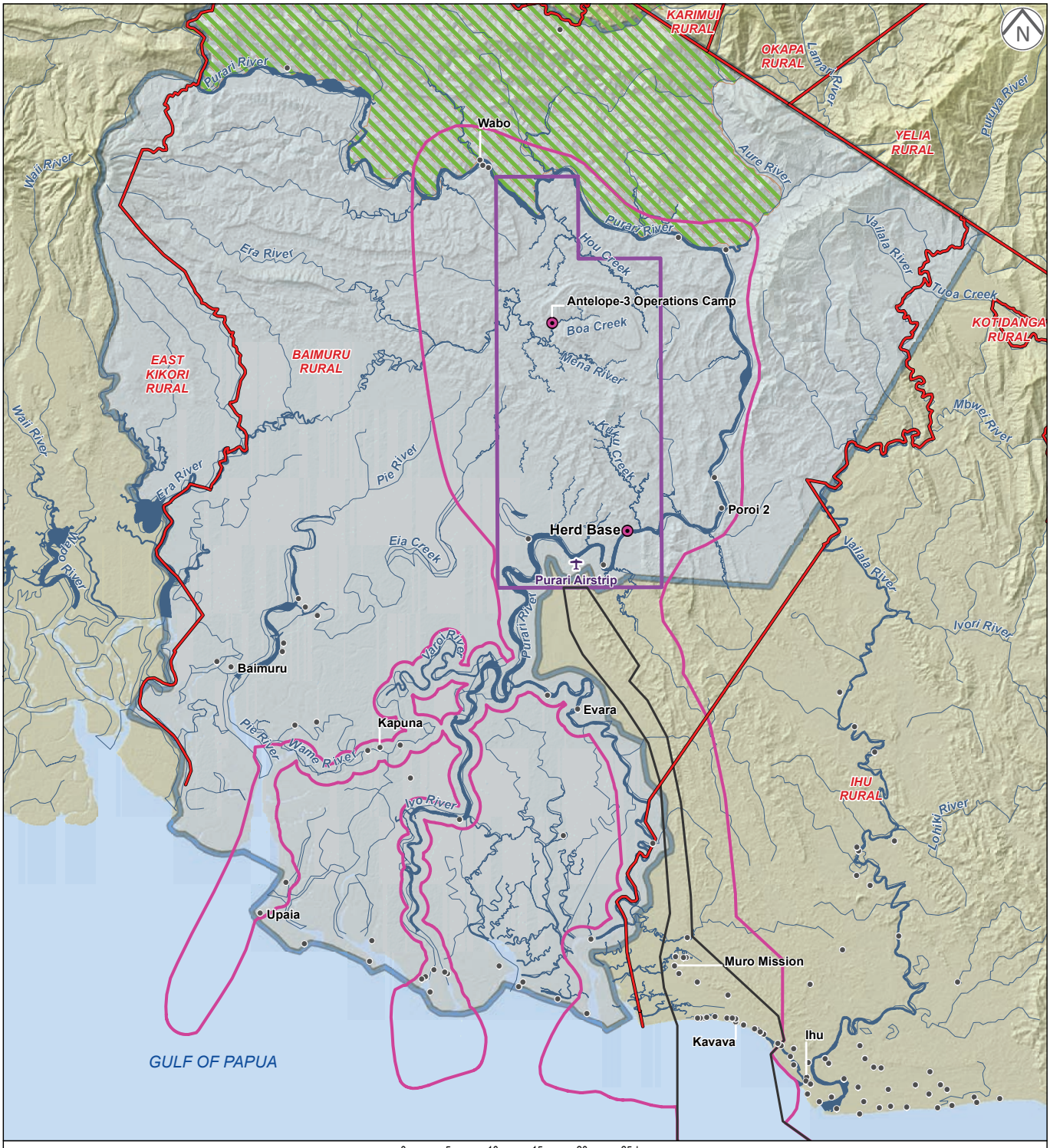
FIGURE 9.8



SCALE: 1:650,000 @ A4

0 5 10 15 20 25 km

COORDINATE SYSTEM: PNG94 PNGMG94 Zone 55

- Town and village
- Base camp
- Airstrip
- Local level government boundary
- Waterway
- Waterbody
- PRL-15
- Export pipeline corridor
- Upstream Project area of influence
- Crater Mountain Wildlife Management Area
- Special Agriculture and Business Lease (SABL)

Communities outside of the Project area of influence have not been verified. Only government administrative centers and notable locations have been labeled for context.

9.8.4.1 Swidden Agriculture/Gardens

In swidden agriculture, land is cleared to create space to plant crops, is used for typically 4 to 12 months until soil fertility declines and then is left to regenerate. Typical crops planted are sweet potato, taro, cassava, cooking bananas, sugarcane, pumpkin, sweet corn, green leafy vegetables (e.g., aibika and aupa), peanuts, snake bean, Chinese cabbage, pitpit, eggplant, cucumber, ginger, chilies, passion fruit, paw paw, pineapple and watermelon.

Gardens are made on hillsides, along the banks of the Purari River and other waterways, in logged-over alluvial forest, across old sand dunes in coastal areas and occasionally in small cleared patches of nipa palms in the mangroves where crops are planted on raised mounds. Bush gardens vary in size but are mostly less than 0.5 ha. The larger and more widespread bush gardens occur toward the coast and are mostly located on extensive alluvial plains. Larger gardens occur at Avavu (inland of Orokolo Bay), many of which have been established after logging of the alluvial forest. The most intensive area of garden cultivation occurs across the Orokolo Bay hinterland where gardens and planted sago extend over at least 1,344 ha and much of the original alluvial forest has been cleared (Figure 9.9).

The four most important community-based income-generating activities from plant-based natural resources are sales of betel nut, sago, surplus garden produce and coconuts. The main source of betel nut is the inland Orokolo villages and Evara (Ahia language group) where dense stands of the betel nut palm have been planted. Average annual household incomes for these villages exceed PGK4,000 (US$1,200).

9.8.4.2 Sago Cultivation

Sago planting and harvesting is the most important food production activity in the PAOI. Sago is the main staple food for all the villages. Sago and coconuts are the most important famine foods. Both are resilient to floods and drought. Sago is harvested from both planted and wild sago stands. Harvesting from planted stands is more common and preferred due to better accessibility and because favored cultivars that have better texture (less watery) and flavor are planted. Sago is planted in three main types of locations that are easily accessed:

- Along the riverbanks of the Purari River and its tributaries from the limit of sago's salt tolerance in the lower Purari River to beyond Wabo.
- On the margins of small creeks and swampy sites inland from the main rivers.
- Throughout the swales of the Orokolo Bay hinterland.

The other main source of sago is the wild stands of sago, which cover approximately 25,351 ha (9%) of the PAOI (Figure 9.10). Yields of between 100 and 150 kg per sago palm are possible and are usually sufficient for a family for a month. Sago palm byproducts are used in all villages for roofing and building.

Sago is sold in 5 or 10 kg blocks (Plate 9.14); Evara had the highest annual household income from sago sales. A range of other items derived from natural resources is sold, including mustard (fruit of the *Piper betel* vine) for chewing with betel nut; mats and small *bilums* made from pandanus; occasionally sedge, bush tobacco, canoe trees and house posts; and rarely copra.

SUBSISTENCE AGRICULTURE IN THE OROKOLO COAST HINTERLAND

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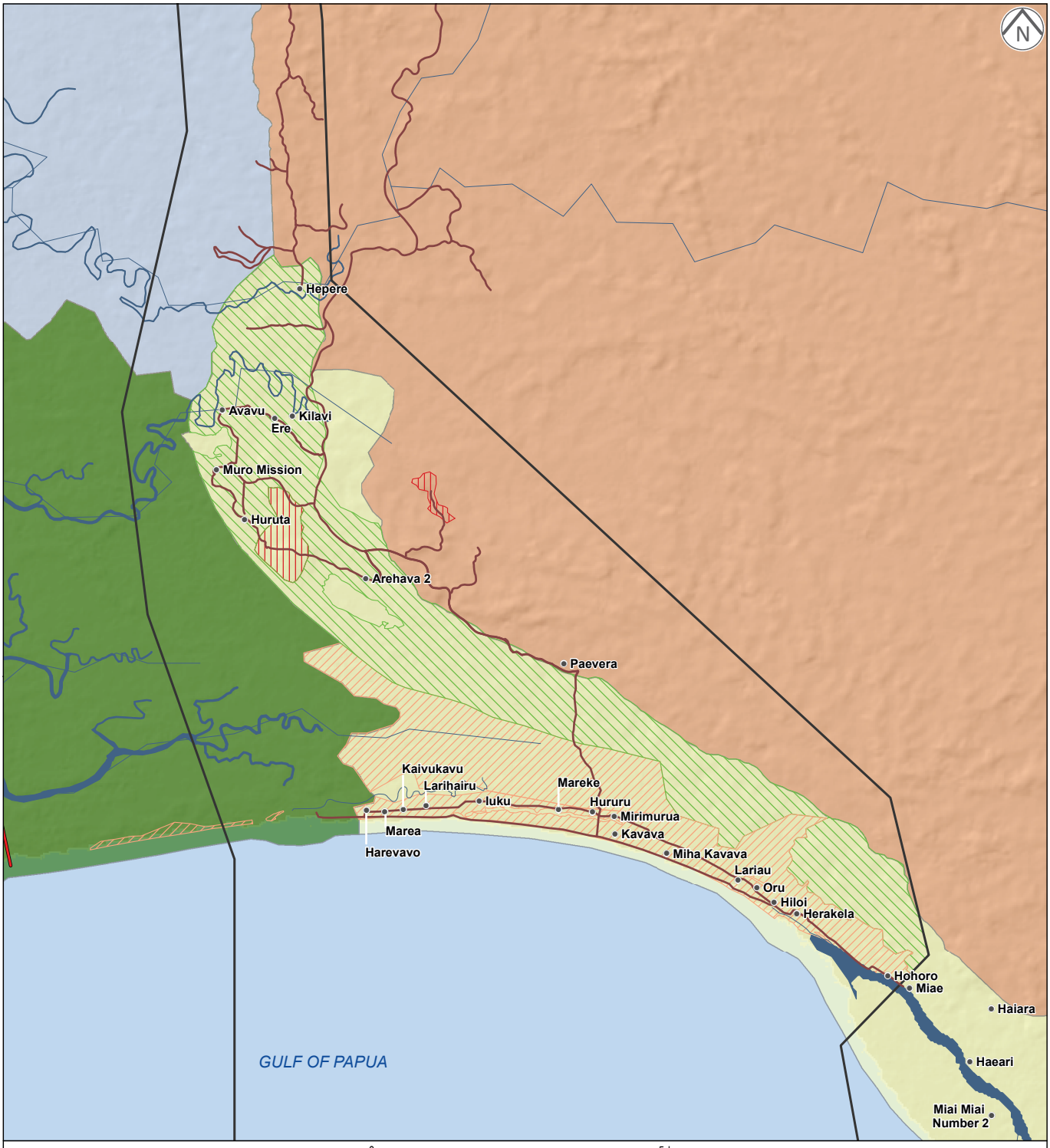
FIGURE 9.9



SCALE: 1:100,000 @ A4 — 0 — 5 km — **COORDINATE SYSTEM:** PNG94 PNGMG94 Zone 55

- Town and village
- Local level government boundary
- Waterway
- Waterbody
- Export pipeline corridor

Garden Types

- Gardens and alluvial forest
- Gardens and sago cultivation
- Gardens and hill forest

Ecological Zones

- Delta Swamps and Plains
- Mangroves
- Southeast Coast
- Southeast Hills

Communities outside of the Project area of influence have not been verified. Only government administrative centers and notable locations have been labeled for context.

WILD SAGO

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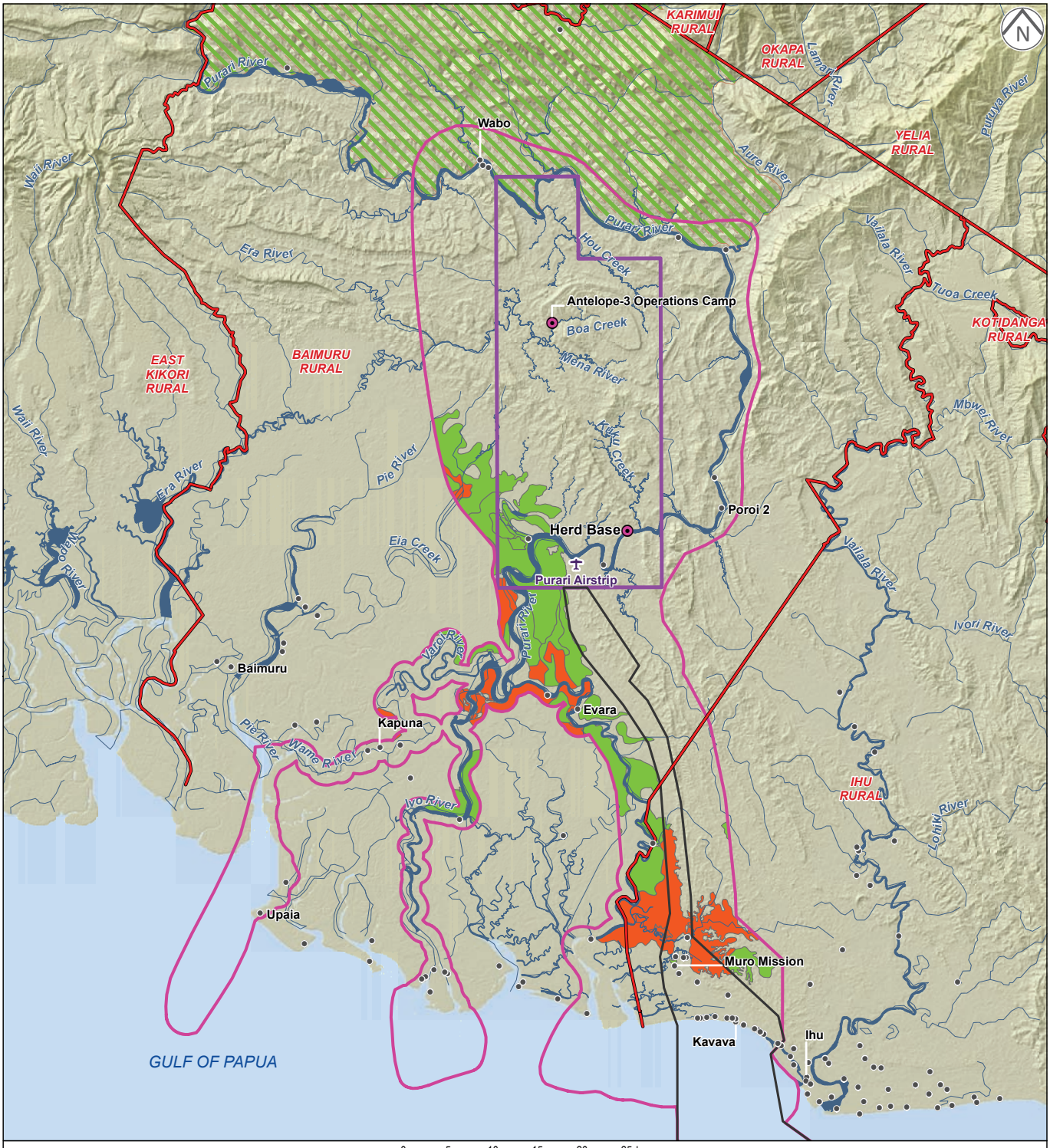
FIGURE 9.10



Communities outside of the Project area of influence have not been verified. Only government administrative centers and notable locations have been labeled for context.

Plate 9.14 – Sago

Photo: ERIAS Group.

9.8.4.3 Planted Fruit and Nut Trees or Palms

Fruit and nut trees are planted in villages but are particularly important in coastal and lowland areas. Okari nut and breadfruit are the most widespread tree species planted. Okari nut is widely eaten and sold seasonally in local markets. Breadfruit is grown wild or in village gardens from seedlings or by propagating root cuttings or suckers. In some varieties of breadfruit, both the fruit pulp and seeds are eaten.

Coconut trees are planted in coastal areas and the inland Orokolo villages. Coconut is an important famine food, particularly in the wet season when gardens and sago plots cannot be accessed due to flooding. The meat can be eaten at all stages of development, and the milk of the green coconut can be consumed during drinking water shortages.

9.8.4.4 Livestock

The only domestic livestock encountered were pigs and chickens; one or both are kept to some extent in all surveyed villages. Pig husbandry practices are broadly similar in the PAOI. Rates of pig ownership differ strikingly between the coastal and Purari River delta villages and the villages located further inland. The highest rates of pig ownership (i.e., more than 60% of households) and the largest groups were reported in the Kaimare, Koriki and Maipua villages. Average group sizes were usually between five and six. The lowest rates of pig ownership were rarely above 10% of households and were recorded among the Iare villages living along the Purari River. The Ahia village of Evara and some Pawaia villages had no pigs at all.

The sale of pigs was sometimes mentioned as an important source of income, although it always ranked below the sales of garden produce, fish or seafood and sago, e.g., by the coastal Orokolo villages, while in other villages the sale of pigs was not rated at all, e.g., all the inland Orokolo villages.

Most households (42 to 86%) keep chickens. The lowest rates of chicken husbandry were recorded in the Pawaia (42%) and Koriki villages (48%), and the highest rates were recorded in the Kaimare villages (83%) and the Ahia village of Evara (86%). The average flock size was 14 birds. The stated importance of chicken sales as a commercial activity varied among villages from no importance to a significant source of income. The household survey indicated that 8.2% of households in the two weeks prior to the survey sold chickens, with average earnings of PGK44 (US$13.20). Only two households reported significant annual earnings from chicken sales, one at Kairu'u (Koriki) with PGK760 (US$228) and one at Upaia (Kaimare) with PGK2,400 (US$720).

9.8.4.5 Non-domesticated Animals

Several kinds of wild animals are occasionally reared from juveniles until large enough to sell or consume. The most common are cassowaries and cuscuses, with crocodiles and wallabies also occasionally reared. Smaller birds are also sometimes kept, with a proportion of these sold.

Data from the household surveys indicated that:

- Sixteen of the 354 households were rearing a total of 22 cassowaries.
- Six out of 354 households reported keeping crocodiles.
- Nine out of 354 households reported noteworthy annual sales from crocodile skins, with sales of PGK300 to PGK800 (US$90 to US$240).

9.8.5 Fishing

Most households in all villages fish. Fishing provides a variable but usually important proportion of the animal food intake and represents an important opportunity to generate income for some villages. In four coastal and delta villages (i.e., Aumu, Variki, Upaia and Ara'ava), the sale of fish and seafood was ranked as the primary source of village income. In other villages, it was ranked behind betel nut, processed sago and garden produce; however, in these villages, women and youths consistently identified fish and seafood products as one of the major opportunities for them to contribute to family incomes. Fifty-three percent of all households claimed annual earnings from PGK360 to PGK21,600 (US$108 to US$6,480). The overall annual average for all vendors was PGK1,722 (US$517), with 9 of the 27 villages recording above-average earnings.

Fishing is focused on the ocean along the Orokolo Bay coast. Fishing also takes place in the tributaries of the Purari River and the network of interconnected channels that make up the delta. Since access to these habitats often involves several hours' travel, fishing typically takes place in combination with other activities such as sago production and hunting. Travel from villages to these locations is usually by paddle canoe. Fishing grounds are reportedly mostly under customary ownership, although sections of the main channels of the Purari River and the coastal marine resources are said to be available to anyone from the local villages.

Fishing methods used are, for the most part, traditional (Plates 9.15 and 9.16), albeit with the addition of modern techniques and equipment, including gill nets and store-bought fishing line and steel hooks.

Sharks, sawfish and rays, barramundi, threadfin salmon and mullet are caught in the marine and brackish river estuary habitats. Black bass, emperors and many catfish species are caught in the brackish estuarine and freshwater river zones. Prawns are common throughout the system, but there is a change from freshwater prawns to saltwater prawns in the estuarine and marine habitats.

Communities in the PAOI believe that increased boat activity on the rivers has led to a reduction in fish stocks over the past decade or so. Many landowners of the freshwater sections of the river point to a near complete decline of several species in these habitats, including barramundi and black bass. Over the same period, people have observed the spread of exotic fish species through the catchment, some of which are now regularly eaten.

Further description of marine fisheries and resources is provided in Chapter 8.

Aquaculture

No examples of aquaculture have been observed in the PAOI. Some exotic species used for aquaculture elsewhere in Papua New Guinea (e.g., tilapia) have established feral populations in PAOI rivers (West & Glucksman, 1976) (Section 7.6.5).

Plate 9.15 – Poison Vine (Growing on Trunk) Used for Fishing

Plate 9.16 – Woman in Orokolo Bay Fishing with Y-net

Photos: ERIAS Group.

9.8.6 Hunting and Collecting

9.8.6.1 River and Coast Animal Resources

The most important riverine and coastal resources hunted and collected in the PAOI are freshwater and saltwater crocodiles, freshwater and estuarine soft-shelled and pig-nosed turtles, the Australian snubfin dolphin and a variety of mollusks and crabs. Additional coastal resources harvested include mangrove worms and crabs, and various small clams, oysters and mussels. Individuals or family groups visit localities where river and coastal resources are known to occur to harvest those resources. Crocodiles are hunted with guns, although many smaller crocodiles are caught collaterally in gill nets.

Seasonal and environmental conditions influence river and coast animal resource availability. For example, each September to December, pig-nosed and soft-shelled turtles migrate upriver from the marine and estuarine zone to lay their eggs in sand banks in the freshwater reaches of the Purari River and its tributaries, and inland inhabitants actively pursue them during this period. Crocodiles are said to lay their eggs at the same time of year. Seasonal breeding also occurs among many bat species. Access to some other animal resources, including wild pigs and cassowaries varies in accordance with water levels in the Purari River catchment., High water levels can restrict access to some areas and resources due to flooding of riverine areas, but they can improve access to other areas, such as inland oxbow lakes that are impossible to access unless water levels are high. Some terrestrial animals, including wild pigs and bandicoots, are said to become concentrated on elevated ground during and after floods, making them easier to hunt.

9.8.6.2 Land Animal Resources

A broad range of resources are hunted and collected in the PAOI, including mammals, reptiles, birds, frogs and insects, and their produce related to life stages and reproduction (i.e., eggs and larvae) (Table 9.16). Consumption of the larger animals (i.e., wild pigs, cassowaries, wallabies and pythons) occurs more frequently in the inland villages than in the near coastal villages; however, monitor lizards, bandicoots and cuscuses are consumed more evenly across all villages. Sago grubs are consumed in all villages.

Table 9.16 – Common Land Animal Resources Hunted and Collected

Habitat	Animal Resource
Forest*	♦ Wallabies, tree kangaroo, echidnas ♦ Cassowaries and eggs ♦ Wild pigs ♦ Pythons and monitor lizards ♦ Bush fowl and eggs ♦ Smaller mammals (rats), birds, reptiles, frogs ♦ Land crabs ♦ Beetle larvae ♦ Honey
Sago plantations	♦ Sago grubs ♦ Eels ♦ Smaller fish ♦ Frogs and tadpoles
Gardens	♦ Small mammals (such as rats and bandicoots) ♦ Bats
Caves	♦ Bats

Source: ERIAS Group (2016a). * Includes hill forest and alluvial forest.

Hunting and collecting methods include:

- Active pursuit: The animal is run down or shot, with bow and arrow or gun, often with the assistance of a trained hunting dog.
- Ambush: Waiting patiently at locations that wild animals are known to frequent.
- Snaring: Setting of noose snares or deadfall traps.
- Harvesting: Collecting animal resources at localities where they are known to occur in regular numbers (e.g., turtle nests).
- Chance encounters: Hunted or collected during other activities, such as clearing gardens, traveling or collecting forest products.

9.8.6.3 Plant Resources

Plant resources are of high value and are universally used in the PAOI. Interviews identified 48 to 94 useful plants from different forest types.[26] The dominant plant uses are house construction, domestic food and domestic medicinal purposes. Of the various useful plants, trees are the most useful, with 580 recorded uses, followed by palms, which have 157 uses. Other useful plants have comparatively few recorded. The main plant uses are:

26 The range in the number of plants identified reflects differences in the plant availability between communities and what they find and recall as useful.

- Hunting and fishing: Plants are used to make hunting and fishing tools. Plants that produce seed and fruit that attract animals are used as hunting sites. Other plants are used as fish poison.
- Medicine: Medicinal plants are used to treat cuts, wounds, skin disease, sores, respiratory infections, general body pain, toothache and malaria. The Pawaia villages have a greater reliance on medicinal plants than other villages.
- Construction: A range of tree species are used in house construction and fencing. Kwila tree logs are a preferred timber for house posts due to their strength and resistance to decay. Roofing thatch is commonly made from sago or nipa palm leaves.
- Food (plants other than garden plants): Hill forest, alluvial forest and, to a lesser extent, swamp forest provide at least 46 plant species that are used to supplement sago and garden food crops.
- Canoes, paddles and rafts: At least 27 tree species are used to make canoes. The most widespread canoe species is a light timber that is easy to hollow out but has a low durability due to attack by insect borers.
- Domestic items: A range of plant species are used to make domestic utensils and coverings and products, such as brooms, floor mats, containers, washing tools and shampoo. The most widely used plants for domestic items are bamboo, palm, rattan and the *Trichospermum* tree.
- Firewood and torches or matches: Firewood is an essential resource for cooking food in the PAOI. Almost any tree species can be used; however, several species are preferred. Firewood is collected from as close to the village as possible to shorten the distance that the wood is carried; however, Orokolo village inhabitants also collect driftwood from the beach for firewood (Plate 9.17).
- Cultural: Plants are used in celebrations, sorcery, dyes and to make *bilums* and mats. The forests provide the greatest range of cultural plants.
- Famine resources: Plants such as wild sago and wild yams are harvested in drought or if food crops fail due to flooding or disease.

Plate 9.17 – Firewood Collected from the Beach

Photo: ERIAS Group.

9.8.7 Subsistence Labor

Village leaders and women were asked about their main responsibilities and how frequently the main activities were undertaken. The division of labor between men and women varies among language groups. Table 9.17 describes the key subsistence activities undertaken by men and women and the results from the household survey, which indicate the proportion of households that performed the activity in the past two weeks. Those activities marked with 'N/A' indicate that the activity was not performed in the past two weeks, but it may be that the activity is not considered a discreet activity that was specifically performed in the period, but rather is an ongoing duty.

Table 9.17 – Activities and Responsibilities Undertaken by Men and Women

Activity	Responsibility	Undertaken in the Last Two Weeks (% of Households)	
		Males	Females
Making sago	Men generally fell and transport the log and sometimes scrape it. Women more often scrape and then beat and wash the sago.	50%	68%
Making gardens	Men are primarily responsible for felling trees, but both males and females clear and burn.	57%	44%
Tending gardens	Women primarily undertake this task, but males are also active. Women in Mariki indicated that it wasn't an important task, as gardens contribute less food in coastal villages of the Purari River delta than in other areas, due primarily to the shortage of suitable gardening land.	66%	56%
Hunting	Primarily men and boys hunt. Hunting occurs less frequently in coastal villages.	42%	5%
Fishing	Both men and women are active. Men set nets and fish with lines, while women use traditional baskets and nets, and also use lines. Fishing generally occurs daily.	75%	72%
Collecting seafood	Primarily women collect seafood; although, men sometimes participate. Collecting seafood is more important in coastal areas.	31%	42%
Collecting edible plants	Primarily women collect edible plants, although men sometimes participate. It can be a designated activity when okari, galip or other foods are in season; more often it is a supplementary activity. Collecting edible plants is more important for inland villages that have access to larger forest areas.	51%	50%
Building a house	Primarily men are responsible for cutting logs, preparing timber and erecting the house frame. Both men and women can make woven wall panels or mats from nipa or sago palms, and women can assist men during construction.	31%	5%
Making canoes	Predominantly men make canoes. Canoes typically last two to three years, so this task occurs relatively infrequently.	51%	16%
Community work	Both males and females undertake community work, generally on a designated day during the week.	59%	56%

Source: ERIAS Group (2016a).

Making sago (Plate 9.18), making and tending to gardens, fishing, collecting seafood, collecting edible plants and community work are all important tasks performed by both men and women.[27] Hunting, making canoes and building houses (Plate 9.19) are tasks that are primarily the responsibility of men, while women spend more time making sago and performing duties around

27 The household survey was undertaken in September/October, a relatively dry period when many people were making new gardens. This may bias the results toward making new gardens to some degree.

the house, including caring for children, collecting water, cleaning and cooking. While both men and women may be involved in an activity, such as making a new garden or making sago, the respective activities may be quite different, e.g., men may fell trees while women clear the underbrush. For sago, men may fell the palm and transport it to a suitable location, where the women will assume responsibility for processing. Young married couples appear to perform many activities together, including, e.g., making new gardens and fishing.

Plate 9.18 – Woman Making Sago Near Evara

Photo: ERIAS Group.

Plate 9.19 – Men Making Roof Thatch From Nipa Palm at Avavu

Photo: ERIAS Group.

The labor burden is shared when either males or females are sick or have limited time due to other responsibilities, and some traditional differences in the division of labor may be eroding.

The following roles and responsibilities are undertaken:

- Protecting the family: this is seen as primarily men's responsibility.
- Caring for children: shared by men and women, although women are often more actively involved.
- Raising livestock: both men and women share the responsibility, although 25% of surveyed households did not have livestock (i.e., pigs, chickens, cassowary or crocodiles).
- Collecting water: shared among men, women and children of all ages in the family, although women and girls are mainly responsible. Women were primarily responsible for collecting water in Kairimai, Ara'ava, Poroi 2, Ere, Avavu, Hepere, Huruta, Oru and Aiere.
- Collecting firewood: shared among men and women of all ages in the family, although men in Larihairu and Iuku said it was not an important task for men.
- Cooking and cleaning: women primarily undertake these tasks.

9.9 Community Security (Law and Order)

9.9.1 Law and Order System and Resolution

In Papua New Guinea, the national judicial system includes the Supreme Court of Justice, the National Court of Justice and various other courts, including district courts and land courts. The Chief Justice has administrative responsibility over the supreme and national courts. The national court has exclusive jurisdiction over human rights and is responsible for protecting fundamental rights to life, freedom from inhuman treatment, and liberty of the person or property. District courts are the frontline of the formal justice system for addressing legal rights, providing a mechanism for administering justice and resolving disputes.

As the national and district courts operate predominantly in urban areas and are not easily accessible to PNG's rural population, village courts, established in 1975, have the primary role of ensuring peace and harmony in the communities in which they operate.

Village Court

The village court system is the main mechanism for dealing with local crimes and disputes. Most village courts appear to be functioning, although to a lesser extent in the Pawaia villages. Some historical issues concerning the payment of officers are yet to be resolved. The village court magistrates are paid a small stipend for their work (e.g., PGK300 to PGK400 (US$90 to $120) per month), but they do not receive transport or phone allowances and do not have offices or office facilities.

Village courts deal with disputes relating to stealing garden produce, disputes over gardens, general bad behavior (e.g., arguments, noise and gossip) and domestic disputes. Village courts are obliged to attempt to resolve disputes with mediation. Traditional or church leaders often play a supportive role to the village court officials. Disputes that cannot be resolved in the village court are referred to the provincial court in Kerema.

More serious crimes, including rape and murder, are referred to the police in Baimuru, Ihu or Kerema, but limited resources mean a considerable delay can intervene between reporting a crime and police attendance.

Land Mediators

Under the law and order system, each local level government in Gulf Province should have four land mediators. Their role is to try and mediate and resolve land disputes between conflicting parties, and they are also involved in any government land purchase. Parties that cannot resolve a land dispute may take their dispute to a local land court hearing, which will include a magistrate and at least two land mediators; if the dispute can still not be resolved, it could go to the provincial or national land courts. The land court operates under the *Land Disputes Settlement Act 1975* specifically to settle disputes relating to customary land.

The role of land mediators appears to be poorly understood, and few villages indicated that they had a land mediator.

9.9.2 Law and Order in the PAOI

Village leaders identified the main law and order problems in the PAOI to be stealing, followed by fighting, domestic violence and marijuana use. Women report a higher level of domestic violence than portrayed by the village leaders who were generally male (Figure 9.11). Youth groups report fighting, domestic violence and stealing as the main law and order problems.

There appeared to be little difference in the type of law and order events occurring in different language groups. While several of the Orokolo villages identified more occurrences of law and order incidents than many of the other villages, this was largely attributed to the involvement of village court officials in the village leaders' meetings during the surveys and the officials' willingness to communicate openly about law and order problems.

The nearest police stations to the PAOI are located at Ihu and Baimuru, with limited logistical resources to maintain a presence in the PAOI. Community members have raised concerns about the violent behavior of reserve police and private security guards stationed at the various logging sites (DIHR, 2017). While not verified during the study, the claims were considered consistent with reports related to logging activities in other parts of the country.

TEP PNG has been working with security forces in alignment with the Voluntary Principles on Security and Human Rights. There have been no significant security incidents at Project sites prior to the assessment.

9.9.3 Sense of Security

Most village leaders (68%) and women's groups (74%) indicated that residents felt safe in their villages. The main safety concerns noted by the village leaders were sorcery and natural hazards, including snakes, crocodiles and floods. Seven of the women's groups indicated that they were not safe; four due to sorcery and three due to social or cultural norms that put them at risk of domestic violence, sexual assault or other forms of violence.

Village leaders and women's groups were asked if the level of security had changed in recent years. While most women indicated no change in the level of security had occurred, 45% of the village leader groups assessed the level of security as improved. This was attributed to the reintroduction and strengthening of the village court system.

The groups of men and women that indicated a declining level of safety and security were from the following villages:

- Aumu, Wabo, Ura, Mareke, Ere and Kilavi (village leaders).
- Evara, Kaivukavu and Larihairu (women's groups).

WOMEN'S GROUP – LAW AND ORDER PROBLEMS

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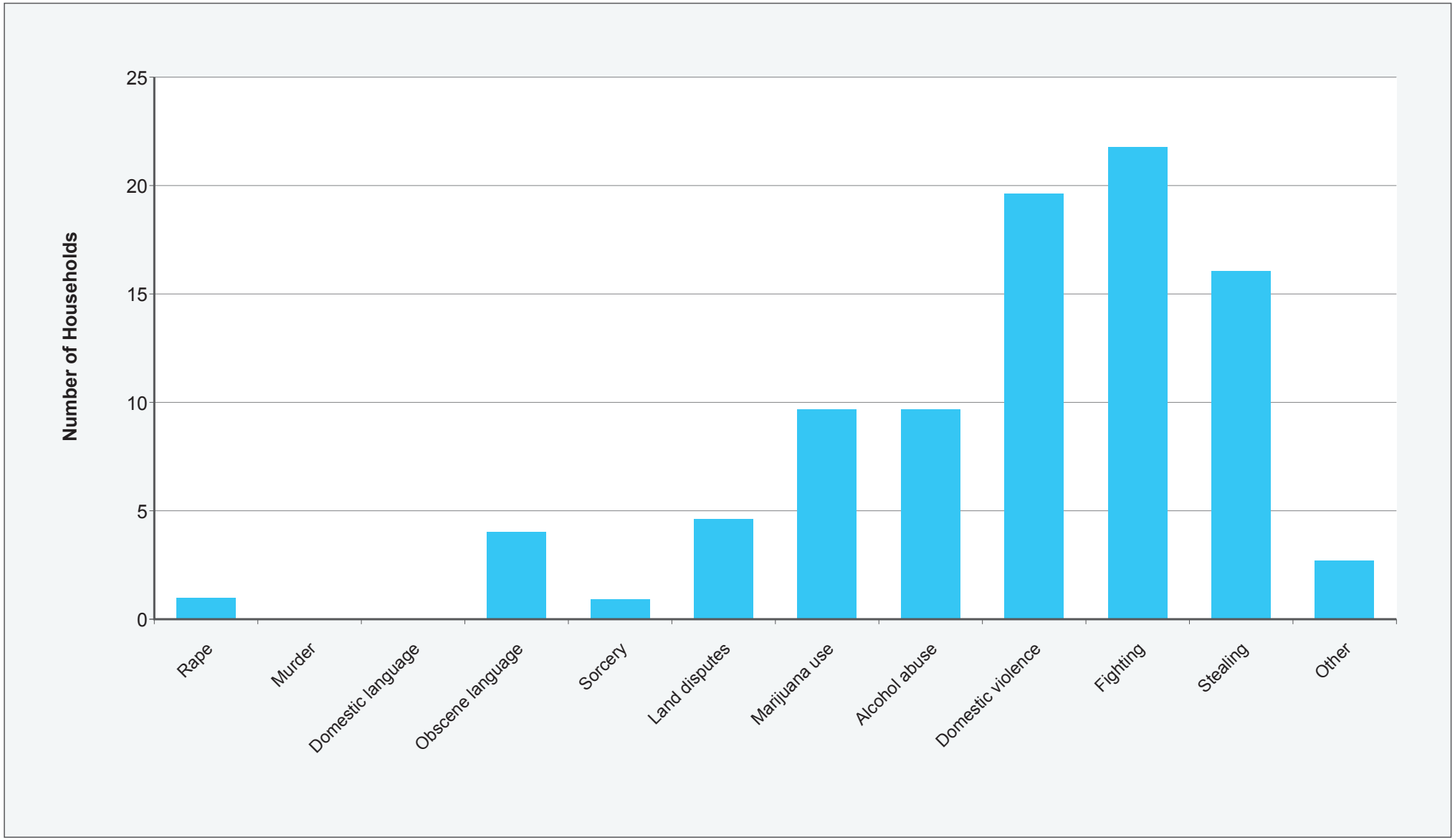
FIGURE 9.11



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The only villages reporting in-migration during the social baseline study were Ura and Wabo. Youth leaders from Wabo indicated that problems resulting from in-migration included domestic violence, fighting, stealing and increased marijuana consumption. Gambling was also attributed to people who had migrated to Wabo Station.

9.9.4 Tensions

In the PNG context, the primary drivers of tension include:

- Disputes regarding land ownership and associated benefit sharing arrangements, complications associated with incorporating land groups, representation, and participation in agreement-making processes.
- Intergenerational tensions, especially as new opportunities emerge for asserting leadership, combined with rapid social and economic changes and the need for younger educated leaders to engage with resource extraction projects and their legal and bureaucratic structures.
- Community dissatisfaction regarding local employment and business opportunities.

There had been no significant tensions related to TEP PNG activities in the PAOI; however, in relation to the primary drivers the following was noted:

- Several landowner representative organizations were in place in the PAOI. Land disputes were a major cause of conflict among Pawaia groups during an earlier social baseline study for a proposed hydropower dam. To some extent, this held for most of the PAOI, as land disputes were a primary source of localized conflict.
- In Gulf Province, logging activities are a cause of adverse impacts and have been linked to new forms of inequality and violence from state and non-state security forces. Many focus group participants registered strong concerns over logging activities.

9.10 Community Transport and Access

9.10.1 River and Sea Travel

Transport around the PAOI is mainly undertaken on rivers with dugout canoes, motorized dugout canoes or dinghies (Plates 9.20 to 9.25). Most trips involve one to four hours' travel from villages to access food gardens, sago processing sites and hunting and gathering sites or to go fishing; but it is not uncommon for people to travel longer and stay overnight or for several nights.

Plate 9.20 – Motorized Canoe

Plate 9.21 – Canoes Moored at Mapaio

Photos: ERIAS Group.

Plate 9.22 – Children Travel by Paddle Canoe near Wabo

Plate 9.23 – Family and Goods Travel by Dugout Canoe with an Outboard Motor

Plate 9.24 – Family and Goods Travel by Paddled Dugout Canoe

Plate 9.25 – Dinghy Departing Harevavo for Sea Travel

Photos: ERIAS Group.

Villagers living along Orokolo Bay regularly transit along the coast to sell marine produce, purchase inland produce and access fishing areas in mangroves, and in nearshore and offshore waters.

Sea travel mostly occurs outside of the trade wind season when the water is relatively calm. The main destinations are Kerema, Kikori, and the Daru and Kamusi logging camps in Western Province.

9.10.2 Roads, Walking Tracks and Airstrips

No public or government roads exist in the PAOI. The only roads are temporary logging roads, which are developed to link harvesting operations to logging camps and export wharfs. Once logging stops, these roads become inoperable due to erosion and vegetation regrowth. The Herd Base—Gas Field Road passes north–south through PRL-15 and connects the now decommissioned Hou Creek Base with Herd Base.

Most villages have walking tracks around their village to access hunting areas, gardens and forest resources. One main coastal walking track connects the Orokolo villages to Kerema; however, it involves crossing the Vailala River. A well-established track connects the inland Orokolo villages of Avavu, Ere and Kilavi with Huruta, Arehava 2 and Paevera in the center and with the coastal Orokolo villages of Harevavo, Kaivukavu, Marea, Larihairu and Iuku. The track is used to access health services and to trade food.

Airstrips are located near Herd Base (Purari Airstrip) and at Wabo (Wabo Airstrip); although, flights from the latter are infrequent. The airstrip near Herd Base services the petroleum drilling operations, and the Wabo Airstrip connects Wabo with the highlands. The airstrips do not have regular commercial air services, but TEP PNG and some private charter flights use them.

9.10.3 Access to Markets

The PAOI has limited organized markets and lacks buyers or market infrastructure to enable sales to other areas. Most sales are casual within villages or with nearby villages. Other local opportunities include selling goods to workers at the Evara logging camp, the Kapuna Health Center and Herd Base. The main organized market in the PAOI is at Kaivukavu; and it operates on Saturday, Monday and Thursday mornings. Other markets are located at the Kapuna and Muro missions. Some villagers travel to remote organized markets outside the PAOI at Baimuru and further west in the Kikori River catchment; however, the cost and time involved in traveling to regional markets deters most potential vendors in the PAOI.

9.11 Cultural Heritage and Archaeology

The historical context of the PAOI is described in Section 9.2.2.

9.11.1 Tangible Cultural Heritage Sites and Materials

Tangible cultural heritage values have a physical presence that can be seen or touched; they include archaeological sites where physical remains of past cultural activity are present (e.g., pieces of pottery or shell on the ground surface); landscape features, such as hills, caves and river mouths; and individual trees or stands of vegetation or other landscape or biogeographic manifestations of spiritual, sacred or ritual significance. In addition, tangible cultural heritage values include movable material cultural items (e.g., ancestral heirlooms and traditionally made items used in day-to-day subsistence or leisure activities).

International Finance Corporation's Performance Standard 8 (IFC, 2012b) defines tangible cultural heritage as:

> (i) tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; (ii) unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls.

Twelve tangible cultural heritage sites were formally recorded during the baseline study. A further cultural heritage site in the PRL-15 oxbow wetlands was documented but not formally recorded due to a lack of access to the site; however, aerial imagery was used to determine its location. These sites and sites recorded from previous studies in the PAOI (i.e., Popo and Irapuipiarumirie) are shown in Figures 9.12 and 9.13.

9.11.1.1 Ancestral Village Sites

All villages have oral traditions that recall the names and locations of their ancestral villages. In some, the exact location of the ancestral villages is not known and in others the names and location of such sites remain confidential to protect ancestral knowledge and limit potential challenges to land rights, e.g., the four Pawaia-speaking villages chose not to provide the names or locations of their ancestral villages.

Eighty ancestral villages were named during the community-level surveys. Nine have known locations, and three were formally recorded during the surveys (Table 9.18).

TANGIBLE CULTURAL HERITAGE SITES (PRL-15)

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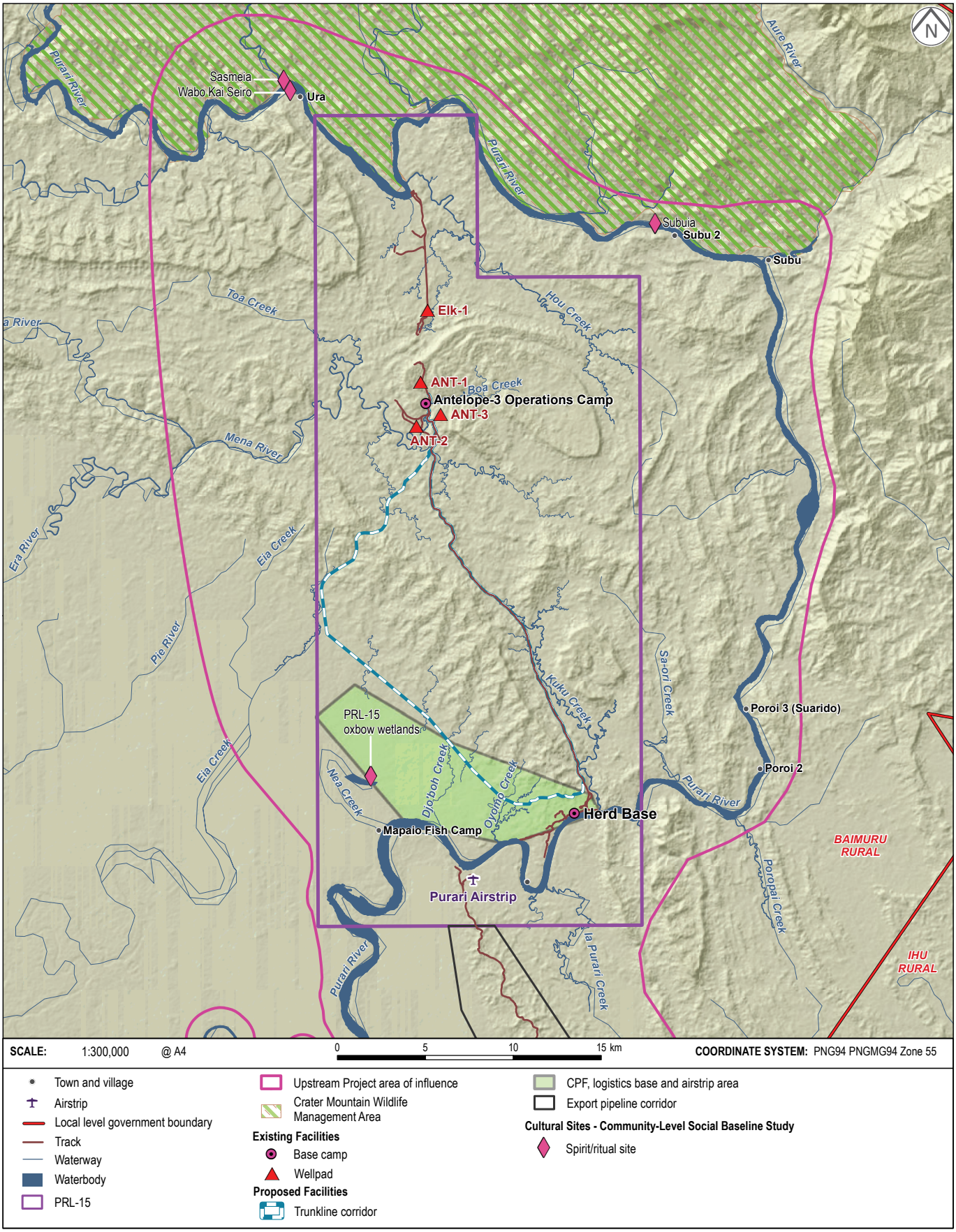
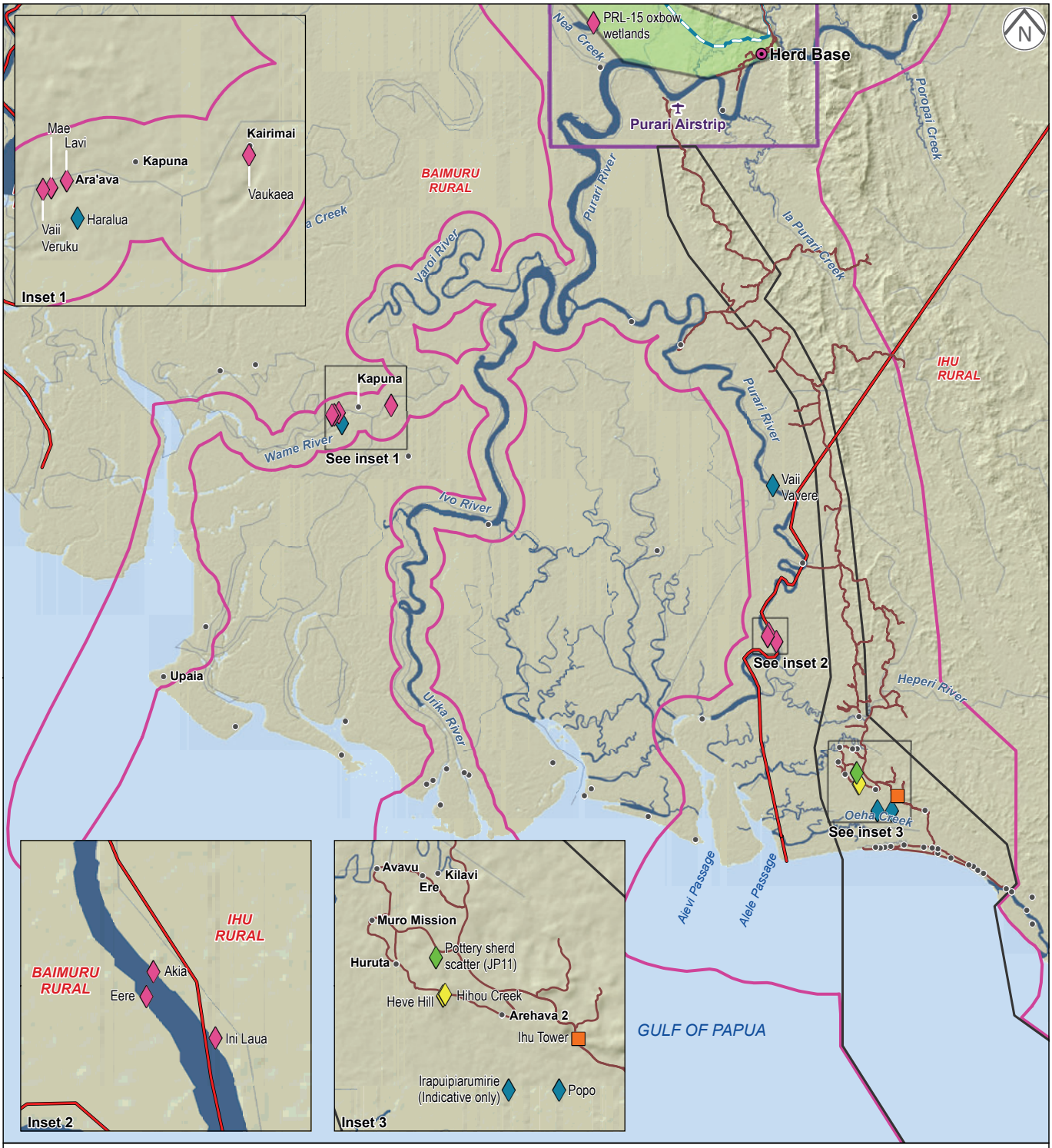
FIGURE 9.12



TANGIBLE CULTURAL HERITAGE SITES (EXPORT PIPELINE CORRIDOR AND RIVERWAYS)

Papua LNG Project | Environmental Impact Statement

FIGURE 9.13



SCALE: 1:400,000 @ A4 — 0 5 10 15 20 km — **COORDINATE SYSTEM:** PNG94 PNGMG94 Zone 55

- Town and village
- Airstrip
- Local level government boundary
- Track
- Waterway
- Waterbody
- PRL-15
- Upstream Project area of influence

Existing Facilities
- Base camp

Proposed Facilities
- Trunkline corridor
- CPF, logistics base and airstrip area
- Export pipeline corridor

Cultural Sites - Community-Level Social Baseline Study
- Ancestral village
- Archaeological site
- Cultural site complex
- Landmark
- Spirit/ritual site

Communities outside of the Project area of influence have not been verified. Only government administrative centers and notable locations have been labeled for context.

Table 9.18 – Importance Ratings for Ancestral Village Sites

Present-day Villages with Connections to Ancestral Villages Recalled in Oral Traditions	Ancestral Village Site	Recorded	Importance			
			Local*	Regional#	National#	International#
Ara'ava	Haralua	Yes	High	Medium	Low	†
Aivai	Vaii Vaivere	Yes	High	Medium	Low	†
Ara'ava, Kairimai, Akoma	Kauri Nu Poke	No	High	High	Medium	†
Aumu	Old Iare	No	High	High	Medium	†
Huruta, Paevera, Ere, Kilavi, Avavu, Hepere, Marea, Harevavo, Kaivukavu, Iuku, Larihairu, Mareke, Kavava, Herakela, Lariau	Heve	Yes	High	High	†	†
Huruta, Paevera, Ere, Kilavi, Avavu, Hepere, Marea, Harevavo, Kaivukavu, Iuku, Larihairu, Mareke, Kavava, Herakela, Lariau	Popo	**	High	High	High	†
Marea	Irapuipiarumirie	No	High	†	†	†
Ere, Kilavi	Kaukpa Horo	No	High	†	†	†
Kaivukavu, Larihairu	Maiaro	No	High	Medium	†	†

* Local importance ratings are based on opinions provided by local informants. # Regional, national and international importance ratings are preliminary and are attributed by Skelly in Part 17 of Volume 2. † There is insufficient information to assign a preliminary importance rating. ** Popo was recorded during a previous study.

9.11.1.2 Spirit Sites

Eight spirit sites have been formally recorded in the PAOI (Table 9.19). Pawaia-speaking villages value spirit sites, and many formally unrecorded sites were in remote locations. Fewer spirit sites were reported closer to the Orokolo Bay coast due to missionary activity and the introduction of Christian beliefs.

Table 9.19 – Importance Ratings for Tangible Spirit Sites

Present-day Villages with Connections to Spirit Sites Recalled in Oral Traditions	Spirit Site	Recorded	Importance			
			Local*	Regional#	National#	International#
Ura	Wabo Kai Seiro	Yes	High	Low	Low	Low
Wabo	Sasmeia	Yes	High	Low	Low	Low
Subu, Ura	Subuia (Plate 9.26)	Yes	High	High	Low	Low
Ara'ava	Lavi	Yes	High	Low	Low	Low
Ara'ava	Mae	Yes	High	Low	Low	Low
Ara'ava	Vaii Veruku	Yes	High	Low	Low	Low
Kairimai	Vaukaea	Yes	High	Low	Low	Low
Aivai	Akia Ini Laua	Yes	Medium	Low	Low	Low

* Local importance ratings are based on opinions provided by local informants. # Regional, national and International importance ratings are preliminary and are attributed by Skelly in Part 17 of Volume 2.

Plate 9.26 – Subuia Spirit Site

Photo: Robert Skelly.

9.11.1.3 Archaeological Sites

Small-sized settlements, frequent relocations and a tropical environment that is not conducive to preserving archaeological materials have combined to leave little or no trace of previous settlements. No known archaeological sites were recorded in PRL-15.

Archaeological sites are known to five of the eleven river transport corridor villages. These occur as shells, stones or pieces of pottery at ancestral village sites. None of the river transport corridor villages reports discovering archaeological materials while gardening. This suggests sites are either rare or deeply covered by sediments in the deltaic landscape.

Conversely, the Orokolo-speaking villages report regularly uncovering archaeological materials when gardening. This suggests considerable cultural activity in the area over a prolonged period (Section 9.2.2), e.g., Larihairu village informants reportedly find pottery sherds all over when gardening inland from the coast. Kaivukavu and Iuku village informants report an abundance of pottery sherds in gardens in the Popo area. A scatter of pottery sherds (Plate 9.27) was identified on one archaeological site during the social baseline study. This site was recorded in an area cleared for gardens north of Heve Hill. The site was given the field code JP11, as the garden area did not have a local name (see Figure 9.13).

Plate 9.27 – Heve Hill Rock Face and Scatter of Pottery Sherds

Photos: Robert Skelly.

9.11.1.4 Women's Sites

Women were invited to participate in all cultural heritage consultations at 34 villages and were represented during consultations at seven villages.[28] Informants from Ura village, where women were not represented during consultations, identify and describe a traditional birthing site, Moiwailedsa, which is attributed high local importance. Women participated in consultation at Apiope village and identified one site, Vaea; however, it is attributed low local importance. Additional women's sites are known but were not named by the villages of Paevera, Aivai and Hepere; and women were not represented at these consultations.

9.11.1.5 Ancestral Heirlooms

Nineteen villages reported keeping ancestral heirlooms in the form of stone tools, shell valuables and clay pots. Possession of shell valuables is more common nearer the coast. Upaia, Ere and Kilavi villagers keep examples of *Hiri* trade pots. Ancestral heirlooms are usually stored away; although, women wear shell valuables as part of the traditional dress in the villages of Evara, Paevera, Harevavo, Iuku and Mareke (Plate 9.28), and they are exchanged as part of the traditional bride price in the villages of Evara, Apiope, Huruta and Mareke.

Plate 9.28 – Shell Valuables (Evara Village)

Photo: Robert Skelly.

28 Women were invited to participate in consultations at all villages but at some villages, they declined for reasons not disclosed. They were involved in women's group discussions about cultural heritage.

9.11.2 Intangible Cultural Heritage Values

Intangible cultural heritage is defined as the practices, representations, expressions, knowledge and skills, and the instruments, objects, artifacts and cultural spaces associated therewith that communities, groups and, in some cases, individuals recognize as part of their cultural heritage (UNESCO, 2003). Fifteen types of intangible cultural heritage values were recorded during the baseline study and are discussed under the classifications of language; oral traditions; song, dance and traditional dress; traditional subsistence knowledge and traditional medicines.

9.11.2.1 Traditional Language

Language groups are discussed in Section 9.2.1.

Traditional language is seen as fundamental in maintaining cultural values and thus the cultural identity of each village; however, informants from Ura, Evara, Mariki, Maipenairu, Aumu and Kavava expressed concerns about the future maintenance of their traditional languages. The main causes of language decline are cited as in-migration, economic change due to local logging activities, marriage to non-village members, the preference among youths to use Tok Pisin and English, and the movement of youth away from the region to seek better education and employment opportunities.

9.11.2.2 Ancestral Oral Traditions

Ancestral oral traditions are discussed in Section 9.2.2.

9.11.2.3 Spirit, Ritual and Sacred Oral Traditions

All four Pawaia-speaking villages and the three Koriki-speaking villages maintain intangible cultural heritage values via oral traditions with traditional spiritual themes. Coastal Koriki-speaking villages are the exception, as missionaries have been most active there. In addition, villages speaking Ahia (Evara), Kaimare (Upaia and Mariki) and Maipua (Apiope) report maintaining oral traditions with spiritual themes.

Missionary activity increases nearer Orokolo Bay; therefore, oral traditions with spiritual themes are reportedly less commonly maintained; only six of the 15 Orokolo villages teach their oral traditions to their youths. Villagers may have maintained more traditional spiritual values than were disclosed during social baseline consultations, given the reported conflict between traditional spirit values and Christian values.

9.11.2.4 Song, Dance and Traditional Dress

Intangible cultural heritage values, such as song and dance, are maintained in 65% of villages.

In PRL-15 and river transport corridor villages, traditional men’s song and dance (Plate 9.29) is still practiced in the Koriki-speaking villages of Ara’ava, Kairimai, Kairu’u, Akoma and Ikinu; in the Kaimare-speaking village of Upaia; and in the Maipua-speaking village of Apiope. The four Pawaia-speaking villages and three of the five Iare-speaking villages no longer practice men’s song and dance but have knowledge of them, which suggests these practices may only have diminished during the lifetime of the current adult generation. Of the Orokolo-speaking villages, three villages (Marea, Larihairu and Kavava) report no knowledge of traditional men’s song and dance; in Huruta village, men’s song and dance is remembered but no longer performed.

Plate 9.29 – Traditional Dancing

Photo: Robert Skelly.

Women's song and dance is reportedly performed in 85% of villages, and women from 47% of villages maintain traditional forms of dress (Plate 9.30).

Plate 9.30 – Traditional Dress

Photo: Robert Skelly.

9.11.2.5 Traditional Knowledge: Subsistence Activities

All villages maintain traditional knowledge related to making the tools and materials used for processing sago (Plate 9.31). Sixty-five percent of villages also report using rituals to enhance sago yields. This practice is most common in Orokolo Bay, with 14 of 15 villages reportedly using rituals.

Plate 9.31 – Tools and Materials used for Processing Sago

Photo: Robert Skelly.

Ninety-five per cent of villages use traditional knowledge when making tools and materials and for hunting rituals or hunting magic. Eighty-five per cent of villages have maintained traditional fishing knowledge.

9.11.2.6 Traditional Medicines

All villages place high importance on maintaining ancestral knowledge related to traditional medicines. Traditional medicines are perceived to be highly effective and, for the villages of Larihairu, Marea and Harevavo, are more reliably obtained than western medicines. This is particularly evident when medical aid posts are not easily accessible or are poorly staffed. Some villages (i.e., Aumu and Apiope) reported a complete reliance on traditional medicines when viable alternatives were unavailable.

9.12 Ethnic Groups

The term ‘indigenous peoples’ is used in this section to recognize the common use of the term in regulatory guidelines and international standards; however, the term masks cultural diversity when used in reference to peoples living in the PAOI. The Project prefers to use the term ethnic groups when referring to indigenous peoples living in the PAOI, other than in this section of the report.

International law provides guidance on the criteria that can be applied to identify indigenous peoples when protecting their rights. In Papua New Guinea, additional characteristics, such as the existence of customary laws and attachment to lands and territories, can also be used to identify indigenous people.

Sections 9.2 to 9.11 describe the cultural and linguistic diversity of the PAOI; its inhabitants’ connection to land; their social, cultural and economic status; and their social, cultural and political institutions. The data presented herein and a review of other independent research and documentation confirm that the communities inhabiting the PAOI can be classified as indigenous according to international criteria.

The term indigenous is not widely used in Papua New Guinea, an independent nation where customary land rights have been retained. The Government of Papua New Guinea does not formally recognize its citizens as indigenous; however, in the 1975 constitution of Papua New Guinea, the fifth National Goal on Papua New Guinean ways states that 'the cultural, commercial and ethnic diversity of our people is a positive strength' and that 'traditional ways of life and culture, including language, in all their richness and variety' must be appreciated. It further states that traditional villages and communities should 'remain as viable units of Papua New Guinean society' and that steps should be taken to 'improve their cultural, social, economic and ethical quality'.

In national legislation, the customary law of indigenous inhabitants is intended to be applied by default unless it is deemed incompatible with written laws or the constitution.[29] In addition:

- A National Cultural Commission was established in 1994 to preserve and promote traditional cultures of the indigenous peoples.[30]
- The *Environment Act 2000* includes provisions to preserve traditional social structures.
- The *Land Act 1996* upholds the propriety rights of customary landowners.
- The *Oil and Gas Act 1998* requires developers to identify customary landowners of license areas.

In 2016, the Papua New Guinea Government accepted the 2011 Universal Periodic Review recommendations to 'take measures to guarantee full respect of human rights to indigenous peoples', to 'review the state policy that affects indigenous lands', and to 'dedicate more resources to ensuring access to basic facilities to indigenous peoples'.

Three prominent instruments relate to the rights of indigenous peoples at international level:

- International Labor Organization Convention 169 on Indigenous and Tribal People (ILO, 1989).
- United Nations Declaration on the Rights of Indigenous Peoples (United Nations, 2007).
- International Finance Corporation's Performance Standard 7 Indigenous Peoples (IFC, 2012c).

The standard international approach to identifying indigenous people is to apply a range of criteria to identify, rather than define, indigenous peoples.

Table 9.20 outlines the baseline data that has been used to demonstrate the international criteria that identify indigenous people in the PAOI.

29 Schedule 1.2(1) of the constitution defines custom as 'the customs and usages of indigenous inhabitants of the country existing in relation to the matter in question at the time when and the place in relation to which the matter arises, regardless of whether or not the custom or usage has existed from time immemorial'.

30 *National Cultural Commission Act 1994*, Article 4(a).

Table 9.20 – Indigenous People in the PAOI

Indigenous People International Criterion	Evidence from PAOI	Report Section
The existence of numerous languages used by different groups for daily communication within and between different communities.	♦ Seven language groups. ♦ Eighty three percent of people speak their local language. ♦ Each village identifies with a single tribe or language group. While clan members may reside in different villages, they only reside in villages speaking the same language.	9.2.1
The presence of different ethnic or tribal groups and basic details on traditional and contemporary forms of leadership, kinship structures, social organization and group formation.	♦ Tribal groups continue to practice traditional leadership. ♦ Two thirds of villages have traditional leaders.	9.3.1
	♦ People are united by language group and clan with a common ancestor or common lineage. ♦ Clans identify themselves and their customary-owned land through oral histories, including genealogies, stories, beliefs, customs and practices.	9.2
Information on the traditional ownership and current occupation and use of specific lands by these groups, and basic details concerning customary land tenure practices or the non-state mechanisms for transmitting land to future generations.	♦ Customary landownership is recognized and fiercely protected across Papua New Guinea; customary landowners have the power to decide what happens on their land. ♦ Ninety seven percent of land in Papua New Guinea remains under customary ownership. ♦ Customary-owned land is held and managed by a range of different customary groups; common among these groups is that this form of ownership is recorded in local knowledge and tradition and recounted orally, rather than recorded in a system of government records.	9.2.3 9.3.1
Basic details concerning the customs and traditions of different groups, including the presence or absence of certain forms of tangible and intangible cultural heritage.	♦ Twelve tangible cultural heritage sites formally recorded, representing the site types that are present in the PAOI: ancestral village sites, spirit sites, women's sites, archaeological sites and ancestral heirlooms. ♦ Important cultural heritage site called PRL-15 oxbow wetlands. ♦ Fifteen types of intangible cultural heritage values identified, including language; ancestral oral traditions; spirit or sacred oral traditions; song, dance and traditional dress; traditional subsistence knowledge; and traditional medicines.	9.11

9.13 Gender

Exploring gender distinctions and the contemporary relationships between males and females in the PAOI was a specific focus of the social baseline studies.

Women's focus groups, facilitated by female researchers, were conducted in all communities, using a dedicated, semi-structured instrument. A range of topics was explored with the women's groups, including the role of women, their part in livelihoods and income, their safety and security, their health, their marriage and their role in decision making. Each session lasted approximately two hours. A summary of the findings is presented in this section, along with the findings of the human rights baseline assessment (DIHR, 2017) related to gender.

Gender distinctions exist in all communities. While there is some variation between the more remote, inland communities and the larger, coastal communities, in general women and girls do not enjoy the same social status nor are they afforded the same rights or able to exert the same influence as men and boys. Some inequalities stem from traditional gender relations, while others are due to more contemporary experiences and influences, including changes to traditional social structures, low levels of governance, and land ownership and livelihood influences. Women are

generally less informed about the Project, compounding their historical lack of knowledge about other development and resource extraction projects in the region.

Cultural practices reinforce the lesser status of women in most communities, particularly the Pawaia communities, as follows:

- Men and women have specific roles, e.g., as described in Section 9.8.7, men clear gardens while women are responsible for their ongoing maintenance, men cut sago palms while women process sago, and women attend to most domestic chores. Labor is often shared between husbands and wives; and while some traditional divisions of labor may be eroding, women in some communities maintain that they have a disproportionate workload and receive little support from men and boys with the hard labor of looking after the family.
- Certain prohibitions apply only to women, such as prohibitions against traveling on their own outside the village and prohibitions against care and sanitation surrounding childbirth that require women to give birth in the bush with limited assistance, as described in Section 9.7.3, which states that 9% of births occur in the bush. Women from the Pawaia villages also face cultural barriers that are not generally experienced in the other villages, e.g., married Pawaia women are not allowed to look at other men, let alone talk to them. This may affect the ability of Pawaia women to seek medical assistance from male health workers, or it may prevent them from traveling or selling goods in markets (Part 14 of Volume 2).
- Opportunities are extended mainly to males, such as education beyond the early primary grades and the opportunity to partake in income-generating activities. Section 9.6.2 states that 32% of males aged 16 years and above have completed Grade 7 compared with only 24% of females. Section 9.4.3 states that 15% of males are formally employed compared with 7% of females.
- Some cultural practices are performed by or apply only to women, such as their exclusion during menstruation.
- Domestic violence against women is widespread, occurring in every village, as described in Section 9.7.9.
- Polygamy, whereby a male can marry more than one female, is practiced in 3% of marriages. As described in Section 9.5.1.3, this is higher (8%, 6% and 5% respectively) in Pawaia, Maipua and Iare communities.
- Strict marriage arrangements persist, especially the betrothal of young females to older males.
- Females' participation in alcohol, tobacco or marijuana consumption is generally considered taboo, yet such consumption is acceptable for males.

Across the PAOI, almost 5% of women aged over 20 years are either divorced or separated, compared to 0.8% of men.[31] Although uncommon, in some communities, separation may lead to accusations of sorcery, placing women further at risk (Section 9.5.1.3).

The average starting age for marriage for girls or women is between 12 and 17, depending on the village (Section 9.5.1.3). This is in contravention of the *Marriage Act 1963*, which stipulates a minimum marriage age of 18. In Pawaia and Ahia villages, women marry especially young.

31 The difference in the proportions of women versus men who are divorced or separated may reflect that more men have remarried or have more than one wife.

Across the PAOI, few women are formally employed or involved in business enterprises; and yet most women from 71% of villages earn income for the household, while some (as opposed to 'most') women from the remaining 29% of villages earn income for the household. No villages responded that women do not contribute to household income. The lowest apparent contribution to household income occurs in the Pawaia villages. In 68% of villages, women have their own money to spend. A further 22% of villages indicated that some women had their own money to spend, while the remaining 10% of villages indicated that women did not have their own money to spend. These villages included Kairimai, Ara'ava and Subu 2. Most women from 71% of villages contributed to household spending decisions, with some women from the remaining villages contributing to spending decisions (Part 14 of Volume 2).

Access to basic healthcare and education is limited, and sexual and gender-based violence resolution is low. Women's groups, which exist in many communities, are often established around church activities and are limited in resources. According to the surveyed women's groups, people that are disadvantaged are primarily cared for by their families. While some civil service organizations, particularly women's and youth groups, appear to play an important role in supporting disadvantaged people, the government provides no services or facilities to assistance. The care provided by the groups includes not only providing shelter, food and clothing, but also the integration of the disadvantaged members of the community into everyday society as much as possible (Part 14 of Volume 2).

The children of single mothers are often cared for and integrated into the mother's family. This ensures the child is cared for and provides the mother an opportunity to participate in other aspects of village life; although, young mothers often withdraw from school and experience some level of discrimination (Part 14 of Volume 2).

9.14 Pre-existing Vulnerability

TOTAL's general specifications (see Section 2.5), the IFC's Performance Standards on Environmental and Social Sustainability (IFC, 2012c), good international industry practice and guidance notes from respected industry and human rights organizations[32] require the identification of vulnerable people and groups that may be potentially and adversely impacted by Project development.

No policy or legislation in Papua New Guinea specifically addresses vulnerability; however, the PNG constitution declares five goals that relate to human development, equality and participation, the collective benefit of natural resources and environment, and the development of PNG ways, which includes recognizing ethnic and cultural diversity.

The constitution also states the entitlement of all Papua New Guineans, irrespective of race, tribe, place of origin, political opinion, color, creed or gender, to basic rights including freedom from inhuman treatment and forced labor.

There are two types of vulnerability:

- Pre-existing vulnerability, where groups or individuals find it difficult to sustain themselves or their families under everyday conditions, irrespective of project development. Groups and individuals with pre-existing vulnerability typically fit within the categories[33] of:

32 Consistent with IPIECA guidelines and DIHR (2017)
33 Social Good Practice Note (IFC, 2003).

  - Indigenous people.
  - Ethnic or religious minorities.
  - Women.
  - Youth and elderly.
  - Disabled or chronically ill.
  - Land users without formal rights.

- Project-induced vulnerability, where groups or individuals have a diminished capacity or lack of capacity to understand, anticipate, cope with, resist or recover from the consequences of a potential impact or other threat. In this respect, a person or group may not belong to a pre-existing vulnerable group but may be vulnerable to project development because of the direct and indirect impacts resulting from a project.

The Project focus will be on identifying pre-existing and Project-induced vulnerable groups and individuals. Identification of these people will be discussed in Chapter 13. The process for identifying vulnerable groups and individuals is summarized in the following sections. This section examines potential sources of pre-existing vulnerability in the PAOI from baseline data so that the Project can take steps to consider potential impacts related to those sources in the early stages of impact identification and assessment.

9.14.1 Approach to Identifying Vulnerability in the PAOI

The following approach has been adopted for identifying potential pre-existing vulnerable people and groups in the PAOI and, later, vulnerable people in relation to the Project:

1. **Local identification:** In a context where a majority of people could be construed as vulnerable or disadvantaged, the criteria used by community members to discriminate those among them that are particularly vulnerable is often a useful starting point for identifying those that need particular attention, as required by IFC Performance Standard 1 and reiterated in Guidance Note 5 Land Acquisition and Involuntary Resettlement (IFC, 2012c). This stage was conducted during the upstream community-level field surveys when participants in village leaders' and women's focus group discussions were asked a series of questions about the presence of individuals, families or groups in the village who were worse off, the aspects that made them worse off and where those people found support, if any.

   These questions resulted from extensive dialogue among the community survey team, including its PNG resources, about the meaning and intent of the concept of vulnerability in the PNG social context. The wording and combination of questions were selected as the best ways to elicit the intended information. One issue was the lack of a Tok Pisin term for vulnerable or vulnerability; thus, the survey focus group discussions had to explore alternative concepts, such as worse off and disadvantage.

   Vulnerability is differentiated from disadvantage, which refers more generally to people with a low level of wellbeing. The concept of disadvantage is easier to explain and more readily understood in Papua New Guinea and was discussed with participants involved in consultations for the baseline surveys.

   The results from the upstream community-level surveys are described in Section 9.14.2.

2. **Pre-existing vulnerability:** The baseline data was assessed to identify potential sources of pre-existing vulnerability in the PAOI, i.e., the indicators that may point to the presence of vulnerable people or groups in the PAOI. Data assessed included self-determination,

household composition, food security, livelihood security, status of women, and levels of literacy and health including disability and impairment. The assessment results are described in Section 9.14.2.

3. **Project-induced vulnerability:** The impact assessment (Chapter 13) identifies groups that may be vulnerable to Project development, i.e., groups and individuals that may be coping day-to-day on their own but that may not cope when changes to their day-to-day lives are caused by the Project's direct and indirect impacts.

4. **Household or individual vulnerability:** Household or individual vulnerability will be identified during more detailed displacement planning when 100% of potentially affected households will be surveyed, as opposed to the approximate 30% surveyed for the baseline studies. This process will be guided by IFC performance standards (IFC, 2012a) and associated guidance notes and handbooks.[34]

9.14.2 Preliminary Vulnerability Criteria

Based on the review of selected vulnerability literature, extractive industry best practices and the findings of social baseline studies, Table 9.21 outlines the preliminary criteria for identifying potential sources of pre-existing vulnerability and, later, pre-existing vulnerable individuals and groups, as part of displacement census and future social surveys. It includes a brief description of the findings for the PAOI.

Potential sources of pre-existing vulnerability were identified by assessing the baseline data against the criteria outlined in Section 9.14.3.

9.14.3 Pre-existing Vulnerability

Tables 9.22 and 9.23 present baseline data on the locations, types and numbers of potential pre-existing vulnerability based on the preliminary vulnerability criteria in Table 9.21. The tables do not infer that the communities listed are vulnerable but rather that the potential source of vulnerability is present among households in those communities to the extent indicated.

Criterion 1: Local Identification

Community-level social baseline surveys asked communities to identify whether any people in their communities were vulnerable.[35] The question was asked of village leaders (leader groups) and women's focus groups. The results are shown in Tables 9.22 and 9.23.

Presence of Disadvantaged People

Women's groups from 58% and leader groups from 81% of villages indicated that their village contained people who were disadvantaged (Table 9.22). Consensus occurred in 10 communities (indicated in Table 9.22). Women's groups from Subu 2, Ura, Wabo, Kairimai, Aivai, Mapaio, Upaia, Apiope, Avavu, Ere-Kilavi, Hepere, Huruta and Paevera believed disadvantaged people were not present in their communities. Leader groups from Ura, Subu, Evara, Avavu, Huruta and Iuku believed disadvantaged people were not present in their communities. Consensus on a lack of disadvantaged people occurred in Ura, Avavu and Huruta.

34 Such as the Handbook for Preparing a Resettlement Action Plan (IFC, 2002).

35 Although the survey instruments used the word 'vulnerable', the questions focused on disadvantaged groups or disadvantaged people when asked in Tok Pisin.

Table 9.21 – Preliminary Vulnerability Criteria and PAOI Findings

No.	Category	Criterion	Pre-existing Vulnerable Groups or Individuals in the PAOI
1	Local-identification	Community views	♦ Women's and leaders' groups from 31 communities identified the presence of vulnerable people in 18 and 25 communities respectively. ♦ Women's groups identified households headed by women, single mothers and widows to be the main disadvantaged groups. ♦ Leaders' groups identified people with a disability and households headed by women as the main disadvantaged groups.
2	Poverty	Households below the national poverty threshold Households reporting no income	♦ Households living below the national poverty line are present in all participating communities in the PAOI (21% to 63% of households). ♦ Most communities have households that did not receive any income in the previous two weeks.
3	Food security	Households reporting regular shortages of food Households reporting more than 40% expenditure on food	♦ Almost two thirds of communities from most language groups (except the Maipua people from Apiope) had households that regularly went a day without eating. ♦ In the Iare, Koriki, Orokolo and Pawaia language groups, 30% of communities had households that spent more than 40% of their income on food.
4	Housing	Households that are severely overcrowded Housing that is of notably poorer quality or condition than the rest of the village	♦ Pawaia and Orokolo language groups had the greatest percentage (46%) of households above the average village household size followed by the Iare communities at 41%.
5	Livelihood security	Households without ownership or user rights to land Households with all members who did not participate in subsistence activity in the past two weeks	♦ Only one or two households from the Orokolo communities of Harevavo and Herekela and the Kaimare community of Mariki did not participate in subsistence activity in the previous two weeks.

Table 9.21 – Preliminary Vulnerability Criteria and PAOI Findings (cont'd)

No.	Category	Criterion	Pre-existing Vulnerable Groups or Individuals in the PAOI
6	Household composition	Households headed by women Households with all female members Households headed by single parents Households with all members greater than 60 years of age Households with a member who is chronically or terminally ill or has a mental or physical disability	♦ Households headed by women were present in all but one language group, especially in Iare communities where they made up almost 10% of households. ♦ Households with all female members were present in five of the seven language groups, except the Koriki and Maipua communities. ♦ Single parent households were present in all language groups except the Ahia community of Evara. ♦ Only the Iare (2% of households), Kaimare (3%) and Orokolo (3%) language groups contained households with all members greater than 60 years of age. ♦ Households with members who were chronically or terminally ill or had a mental or physical disability were present across all language groups (6% to 39% of households).
7	Access to infrastructure	Households without access to electricity	♦ Most communities had households that did not have access to electricity across all language groups; the greatest was among Koriki communities (55% of households).
8	Education	Households with no members literate	♦ 19% of males and 33% of females aged 16 years and above indicated that they could not read or write.
9	Women	Households with women: With no access or rights to land With no access to income-generating activity With no money of their own to spend Who appear to have been ostracized by their family or community	♦ In 68% of villages across all language groups, most women had their own money to spend or save.

Women's groups identified households headed by women (leader groups agreed), single mothers and widows to be the main types of disadvantaged people in communities (Table 9.23). Village leaders identified disability as a main type of disadvantage, second to households headed by women. Subsequent findings of the household survey indicated that 7% of households are headed by women and approximately 8% of people had a disability of some kind.

For those villages in which women's groups identified people that were disadvantaged, the number of disadvantaged people was generally described as 'some'.

Both groups indicated that people who are disadvantaged are overwhelmingly cared for by their families. While some civil service organizations, particularly women's and youth groups, play an important role in supporting disadvantaged people, no government services or facilities provide assistance. The care provided by the families includes not only providing shelter, food and clothing, but also integrating the disadvantaged members of the community into everyday society as much as possible.

The children of single mothers are often cared for and integrated into the mother's family. This provides care for the child and allows the mother an opportunity to participate in other aspects of village life; although, young mothers often withdraw from school and experience some level of discrimination.

Criterion 2: Poverty

Household-level social baseline surveys asked each participating household to recall the income received by their households in the previous two weeks (Section 9.5.5.1). This data, when compared with the national poverty line of PGK3.82/day (US$1.15/day), shows that households in all participating communities are living below the national poverty line, from 21% among the Ahia people at Evara to 63% among the Maipua people at Apiope. Most communities had households that did not receive any income in the previous two weeks, and a greater percentage of these occurred among Iare people, followed by the Maipua people at Apiope. More than half of the households in most communities received some income in the period except for the Iare communities of Mapaio Fish Camp and Kapai 2 and the Pawaia communities of Subu and Subu 2. Poverty is identified as a potential source of pre-existing vulnerability among many households in most communities when income levels are compared with the national poverty line criterion.

Criterion 3: Food Security

Food security is described in Part 18 of Volume 2 and Section 9.7.2. Households were asked if the family regularly went a day without eating anything, and almost two thirds of communities from most language groups, except the Maipua people from Apiope, had households that answered positively. Of those communities in which households responded positively, the greatest number of households was from the Ahia people from Evara (21%), followed by 12% of households in the Kaimare and Pawaia communities. Comparing answers to two questions asked in the household survey relating to income received and food expenditure indicates that 30% of communities from the Iare (31% of households), Koriki (13%), Orokolo (16%) and Pawaia (11%) language groups had households that spent more than 40% of their income on food. A notable cohort of households across most communities do not have food security; this is a potential source of pre-existing vulnerability.

Criterion 4: Housing

The average household size was determined from community-level surveys (mapping) in each community, and households that were larger than the average household size in their village were identified as a proxy for overcrowding. Household size is shown in Table 9.3 in Section 9.5.1.1.

Table 9.22 – Villages with Disadvantaged People Present

Language Group	Villages Surveyed	Number of Villages with Disadvantaged People		Name of Villages with Disadvantaged People	
		Women's Groups	Leaders Groups	Women's Groups	Leaders Groups
Pawaia	5	2	3	Subu, Poroi 2	Poroi 2, Wabo*, Subu 2
Ahia	1	1	0	Evara*	N/A
Koriki	4	3	4	Akoma-Kairu'u, Ara'ava, Ikinu	Kairimai*, Ara'ava, Akoma-Kairu'u, Ikinu
Iare	5	3	5	Aumu, Kaevaria, Maipenairu	Mapaio*, Kaevaria, Aivai, Aumu, Maipenairu
Kaimare	2	1	2	Mariki	Upaia*, Mariki
Maipua	1	0	1	N/A	Apiope*
Orokolo	13	8	10	Harevavo, Iuku*, Kaivukavu, Kavava, Larihairu, Marea, Mareke, Oru-Lariau-Herekela	Ere-Kilavi*, Hepere*, Paevera*, Harevavo, Kaivukavu, Kavava, Larihairu, Marea, Mareke, Oru-Laria-Herekela
Total	**31**	**18**	**25**		

* Communities where consensus existed between womens groups' and leaders groups' responses.

Table 9.23 – Types of Disadvantaged People

Language Group	Household Headed by Women		Household Headed by Elderly		Single Mothers		People with a Disability		Widows		Orphans		Other	
	Women	Leaders	Women	Leaders	Women	Leaders	Women	Leaders	Women	Leaders	Women	Leaders	Women	Leaders
Pawaia	1	1	2		1	1	1	1			1			
Ahia	1		1				1							
Koriki		1	1		1	1		2	2					
Iare	2	4			2	1	2		1				1	
Kaimare	1	1			1									1
Maipua		1												
Orokolo	2	4		2	2		1	3	4		3		1	1
Total	**7**	**12**	**4**	**2**	**7**	**3**	**5**	**6**	**7**	**0**	**4**	**0**	**2**	**2**

The Pawaia and Orokolo language groups had the greatest percentage of households above the average village household size at 46% each, followed by the Iare communities at 41%. Overcrowding is likely to exist to some extent in all language groups and is a potential source of pre-existing vulnerability.

Criterion 5: Livelihood Security

The proxy for livelihood security was derived from the household survey question relating to householders' participation in subsistence activity in the previous two weeks. Only one or two households from the Orokolo communities of Harevavo and Herekela and the Kaimare community of Mariki did not participate in subsistence activity in the previous two weeks (i.e., 11% of communities and 3% of each of those two language groups). Given the extent and importance of subsistence activity in the PAOI, failure to participate in subsistence activity over an extended period of time is likely to contribute to hardship and vulnerability, but they are not present at this time.

Criterion 6: Household Composition

Criterion 6 addresses the presence of households that are headed by women, that have all female members, that are headed by single parents, that have all members aged more than 60 years of age or that have a member who is chronically or terminally ill or has a mental or physical disability. These characteristics were identified in both literature and case studies as potential contributors to pre-existing vulnerability.

The Ahia community of Evara had no households headed by women. Households headed by women were present in all other language groups, especially in Iare communities where they made up almost 10% of households. In other communities, households headed by women made up between 1% and 6% of households.

Households with all female members were present in five of the seven language groups, excluding the Koriki and Maipua communities. Orokolo communities contained 19% of households with all female members, whereas Pawaia communities contained just 1% of households that comprised all women. Households with all female members were from 3% to 14% of households in other communities.

Single parent households were present in all language groups except in the Ahia community of Evara. Orokolo communities contained 16% of single parent households, whereas Pawaia communities contained just 4% of single parent households. Single parent households were from 6% to 13% of households in other communities.

Only the Iare (2% of households), Kaimare (3%) and Orokolo (3%) language groups contained households with all members greater than 60 years of age.

Households with members who were chronically or terminally ill or had a mental or physical disability were present in all language groups (6% to 39% of households). Rates were highest among Orokolo communities (39% of households) and high in Iare communities (23%).

As potential sources of pre-existing vulnerability, households that are headed by women, that have all female members, that are headed by single parents, that have all members aged more than 60 years of age or that have a member who is chronically or terminally ill or has a mental or physical disability, exist in all communities.

Households headed by women, single mothers and widows are among the most vulnerable and disadvantaged people in the PAOI (DIHR, 2017). Pawaia women have been described as

marginal, subordinate, disadvantaged, vulnerable and second class, and they face numerous cultural barriers that may not be experienced by other women.

Criterion 7: Access to Infrastructure

Access to electricity is discussed in Section 9.5.4.2. Most communities across all language groups had households that did not have access to electricity. The absence of access to electricity was greatest among Koriki communities (55% of households), followed by the Ahia people at Evara (50%). Other communities without access to electricity were from 11% of households (Kaimare) to 45% among Orokolo communities. No or limited access to electricity is a source of potential pre-existing vulnerability, e.g., it prevents people from fulfilling basic needs, generating income and communicating.

Criterion 8: Education

Forty-one percent of communities had households in which all members were illiterate. About one third of households in Aiere (Kaimare) and Wabo (Pawaia) had no literate members. Literacy levels are shown in Table 9.9 in Section 9.6.2.

As discussed in Section 9.6.2, in the PAOI, 19% of males and 33% of females aged 16 years and above indicated that they could not read or write. Literacy levels were particularly low among males and females from the Ahia language group at Evara and for females from the Pawaia and Kaimare communities.

Criterion 9: Women

Gender is discussed in Section 9.13. As one indicator of potential pre-existing vulnerability, community-level surveys asked women's groups if women in their community had money to spend or save. Women indicated that in 68% of villages, across all language groups, most women had their own money to spend or save. A further 22% of villages indicated that some women had their own money to spend or save, while the remaining 10% of villages, i.e., the Koriki communities of Kairimai and Ara'ava and the Pawaia community of Subu 2, indicated that women did not have their own money to spend.

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