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13. SOCIAL AND CULTURAL IMPACT ASSESSMENT

13.1 SOCIAL IMPACT ASSESSMENT

This section identifies and assesses the Project's potential social impacts. Potential impacts have been assessed for two study areas:

- National and provincial study area. This area encompasses the Independent State of Papua New Guinea, with a focus on the National Capital District (NCD), including the capital, Port Moresby.
- LNG Plant study area (i.e., communities adjacent to the LNG Plant) (see Figure F045 in Chapter 9 Social Environment). The study area commences in the south at the north-western boundary of the NCD, extending north into Central Province to Lea Lea village. The eastern boundary is located approximately 3 km inland from the LNG Plant and extends to the west to encompass Caution Bay, which is used by communities for marine resource harvesting. Landowner villages in the study area include Porebada, Boera, Papa and Lea Lea¹.

This social impact assessment uses an organising framework of social value. A social value is defined as a quality of the social environment that is conducive to people's wellbeing now and into the future, and for which people have high regard. Wellbeing is a broad ranging concept that is perceived differently by individuals as it relates to their goals, expectations, standards, and concerns. It can be affected in a complex way by a range of factors such as a person's health status, beliefs, social relationships, access to services, their relationship to the physical environment and to less tangible aspects such as cultural identity.

The social values in the study areas were developed inductively, based on a review of available information, including:

- PNG LNG Project Social Impact Assessment (Goldman 2009)
- PNG LNG Project Environmental Impact Assessment (Coffey Natural Systems 2009)
- Partnership in Health Project Progress Reports, 2011 to 2018 (IMR various dates)
- Media articles on issues within the study areas
- Academic literature
- Non-government organisation reports on the PNG LNG Project
- Findings from household surveys and focus group discussions undertaken for the Project.

Five identified social values were grouped into three overarching themes, namely:

- **Livelihood:**
 - Social Value 1: The capacity to support livelihoods based on the harvest of natural resources.
 - Social Value 2: Availability of opportunities for participation in the cash economy.
- **Culture:**
 - Social Value 3: The ability to sustain cultural identity and traditions.
- **Personal and community wellbeing:**
 - Social Value 4: An environment supportive of personal, family and community health, safety, security and social wellbeing.

¹ A portion of Lea Lea (also known as Lealea) is often referred to as Bogi. This report includes Bogi as part of Lea Lea.

- Social Value 5: The availability of services and institutions supportive of community wellbeing.

The current status of the social values within the study area is detailed in Appendix C Social Baseline and Chapter 9 Social Environment.

Potential social impacts are identified through an understanding of how Project-related activities (mechanisms of change – see Section 13.1.2) may result in or contribute to changes to social values. A social impact occurs when these changes are experienced by people and communities. Identified potential social impacts were assessed qualitatively using the method described in Chapter 5 Overview of Impact Assessment Method. The primary elements of this method are characterised by determining the underlying sensitivity of the social value, and the magnitude of the potential change to this social value, where:

- The underlying **sensitivity** is determined with respect to its importance and resilience to change. Importance may be indicated by cultural importance or its economic value. It may also be indicated by the uniqueness or rarity of a place or service, including its occurrence, abundance, and distribution within and beyond the study area. Resilience to change is determined by the extent to which a place, service or community can cope with or withstand changes without affecting its value.
- The **magnitude** of the potential change to this value is determined with respect to the scale, affected population, and duration of an impact.

An initial impact assessment for all potential impacts has been undertaken, which assigns a level of significance to each of the potential social impacts identified. This initial assessment does not incorporate the effect of any potential management measures that may reduce the significance of the impact.

Mitigation measures have been identified to avoid, minimise or otherwise manage potential adverse impacts and to assist in the realisation of potential beneficial impacts.

A residual impact assessment was completed for each of the identified potential social impacts. The residual impact assessment assumes that the identified mitigation measures have been successfully implemented and therefore provides an assessment of the significance of the Project's anticipated impacts. Residual impacts are determined through an assessment of how the proposed mitigation measures reduce the **magnitude** of the potential impact on a social value with respect to the scale, affected population and duration of a potential impact.

The social impact assessment was informed by the findings of specialist studies conducted for the Project's EIS, including the following:

- Community Health Baseline (Appendix B)
- Traffic and Land Use (Appendix D)
- Noise Impact Assessment (Appendix G)
- Air Quality Assessment (Appendix J).

Following the initial significance assessment, management measures to mitigate potential adverse social impacts and enhance potential beneficial impacts were identified. The residual significance of identified potential social impacts was then assessed, assuming the effective implementation of the proposed management measures.

13.1.1 Approach to impact assessment

The social impact assessment presented in this chapter was undertaken in line with the legislative and regulatory requirements detailed in Chapter 4 Legal, Administrative and Planning Framework. In addition to these requirements, the approach to identifying, assessing, and managing the Project's potential social impacts was informed by the industry practice guidelines summarised in Table 13.1.

Table 13.1 Industry practice standards and their relevance to this social impact assessment

Guideline	Summary and relevance to the impact assessment
<i>Equator Principles IV</i> (EPIV) (Equator Principles Association 2020)	The EPIV provides a framework for financial institutions to assess and manage the potential environmental and social impacts of projects seeking funding. For projects with potentially significant adverse environmental and social impacts, the EPIV require clients to identify and assess the scale of these impacts and propose measures to minimise and mitigate or otherwise offset, compensate, or remedy risks to workers, affected communities, and the environment. The requirements of the EPIV informed the method adopted to develop this social impact assessment.
<i>International Principles for Social Impact Assessment</i> (Vanclay 2003)	This guideline provides a set of principles to guide SIA practice, which are broadly accepted internationally and have influenced the development of the social impact assessment for this Project.
The IAIA (2015) Social Impact Assessment: Guidance for assessing and managing the social impacts of projects	This guidance builds on the <i>International Principles</i> and provides advice on good practice in undertaking SIAs and the adaptive management of identified potential social impacts.
International Finance Corporation (IFC) (2012) <i>Performance Standard 1 (PS 1) Assessment and Management of Environmental and Social Risks and Impacts</i> and <i>Performance Standard 7 (PS 7) Indigenous Peoples</i>	This social impact assessment was informed by the requirements of the following PS: • PS 1: Assessment and management of environmental and social risks and impacts. PS 1 requires proponents to identify and assess a project's potential social impacts and develop programs to manage these impacts. The assessment will identify individuals and groups that may be disproportionately affected by the project and will propose differentiated measures to manage these impacts. • PS 7: Indigenous Peoples. PS 7 requires proponents to anticipate and avoid potential adverse impacts from their projects on Indigenous peoples and promote sustainable development for Indigenous peoples (IFC 2012b). Construction of new Project facilities and associated potential impacts will be assessed against PS 7 to determine potential requirements relating to free, prior, and informed consent.

13.1.2 Mechanisms of change and impact identification

This section describes the mechanisms of change that may affect the social values arising from the construction and operation of the Project, and describes what these effects may be. The mechanisms were identified following a review of the project description (Chapter 2 Project Description), along with a review of relevant literature, including the documented outcomes of the PNG LNG Project. The mechanisms of change include:

- Employment
- Procurement
- Project-induced in-migration
- Project construction and operation activities
- Papua LNG Project benefit streams.

13.1.2.1 Employment

A workforce of between 5,000 and 7,000 full-time equivalent personnel will be needed to construct the Project over a planned four-year period between 2024 and 2028. The workforce required for construction of the Project is anticipated to peak at around 7,000 in month 24, which is scheduled to be in 2026 (see Figure 2.7, Chapter 2 Project Description).

Project activities that generate employment during the construction phase are anticipated to include but not be limited to:

- The installation and development of temporary construction facilities, such as camp and site offices
- Site preparation
- Civil works
- Rigging
- Cable pulling
- Instrumentation activities
- Insulation installation
- Painting.

Many construction positions involve working in craft specific crews (concrete, steel erection, electrical, etc.) and will be filled on an as-needed basis (in other words, for the duration of that craft scope and not necessarily for an entire year). Therefore, the actual number of people employed during construction will be different from the number of full-time equivalent positions shown in this EIS.

The workforce will consist of Papua New Guinean and expatriate workers, contractors, and support staff. Papua New Guinean citizens originating from within the representative landowner companies' area will be prioritised for employment, followed by Papua New Guinean citizens from the overall provincial area, followed by Papua New Guinean citizens from outside of the provincial area. EMPNGA and contractors will work to prioritise Papua New Guineans, aligning with Project requirements and required worker skills, as described in the Project's National Content Plan (EMPNGA 2023).

The National Content Plan (EMPNGA 2023) includes a combination of fair, transparent measures intended to maximise the opportunities for Papua New Guinean recruitment and workforce development. In the event that recruitment efforts prove unsuccessful in identifying Papua New Guinean citizens with the necessary skills, recruiting efforts will then consider international labour sources. Recruitment of foreign nationals will be conducted in full compliance with the Government of Papua New Guinea Department of Labour and Industrial Relations Work Permit Guidelines governing foreign employment in PNG. Based on current assessments of available labour and skills, depending on the phase of construction, the total workforce to be filled by Papua New Guineans is estimated to be around 20% with an ambition to maximise the opportunities to Papua New Guineans, where possible, through the National Content Plan (EMPNGA 2023). The remaining positions will be filled by expatriate staff.

The permanent operations and maintenance workforce is expected to increase by approximately 50 operations and maintenance technicians to support the integrated LNG Plant. Support staff is anticipated to increase and will be evaluated throughout FEED. Permanent personnel will work a 28 day on / 28 day off rotation with 12-hour shifts for most LNG Plant operations, maintenance, and key logistics positions. Due to the proximity to Port Moresby, some positions at the LNG Plant will be non-rotational, with personnel living in accommodation in Port Moresby and commuting daily to the LNG Plant.

A construction camp will be established within the LNG Plant site, to the north of the existing operations camp (Camp A). Camp A has approximately operational 500 beds, of which approximately 300 personnel represent the steady state requirement on site. This provides approximately 200 beds for overflow capacity for events such as major maintenance programs and unplanned events. The existing Camp A will not be expanded and is sufficient to meet increased capacity for the Project, and that of the integrated LNG Plant. The staffing change from a 28/28 rotation to a walk-in/out strategy for local workers decreases the overall camp requirement during operations from 300 to 200 by 2026.

Start-up of the Project's operation is expected to require a mix of expatriate personnel and Papua New Guineans; however, it is anticipated that the operation will transition to predominantly being staffed by Papua New Guinean personnel over time. To facilitate this transition to predominantly Papua New Guinean personnel, the Project will build on EMPNG's existing program to recruit and hire Papua New Guineans that includes comprehensive general and project-specific skills training provided prior to and after start-up. Expatriate operations staff will provide needed operations experience and serve as mentors to the Papua New Guinean staff to accelerate skill development.

13.1.2.2 Procurement

The Project will generate a range of opportunities for third-party contracting. In line with the requirements of the *Oil and Gas Act 1998*, EMPNGA will optimise the participation of Papua New Guinean suppliers, with an emphasis on representative landowner companies, where goods and services offered are competitive in quality and price, and subject to compliance with ExxonMobil standards for safety and commercial management.

Based on the current Project design, it is expected procurement opportunities will include but not be limited to opportunities in the following sectors:

- Camp and site services sector, including facilities management and catering services.
- Construction and heavy civil sector, including civil works, design and construction of buildings, and paving and road works services.
- Maritime services, logistics, and warehousing sector, including shipping, receiving, logistics, and warehousing services.
- Security and land personnel transport sector, including security services, land transportation, and auto-repair.
- Metallic and non-metallic pipes and parts sector, including the provision of metallic pipe, fittings and valves; fabricated metallic and non-metallic products and parts; and maintenance and repairs of pipes and associated parts.
- Operations services sector, including maintenance and repair services.
- Professional service sector, including engineering, testing, and inspection services; professional and consulting services; and quality assurance services.
- Technical electrical and mechanical engineering sector, including electrical and mechanical equipment manufacturing, procurement, and installation.

13.1.2.3 Project Induced In-Migration

Project-induced in-migration (PIIM) refers to the movement of people into an area in anticipation of a project's economic opportunities, such as employment, business development, and compensation. PIIM is common in resource projects in Papua New Guinea and in some instances, has led to significant population growth (Keenan 2017; Bainton and Banks 2018).

PIIM was identified as a potential impact in the PNG LNG Project Social Impact Assessment (Goldman 2008). Consequently, the PNG LNG Project monitored PIIM of project areas (including the LNG Plant villages) from 2011 to 2014 through analysis of data collected by PNG IMR and other sources (Rina Consulting 2015). A PIIM monitoring report (IESC 2015) concluded that some PIIM had occurred, particularly during construction; however, the scale and rate of in-migration did not overwhelm the assimilative capacity of these communities.

PIIM can also drive a wide range of other potential impacts, including potential impacts on land and water resources, community health and safety, community cohesion and law and order, and tradition and culture. These potential impacts are addressed in their respective categories.

13.1.2.4 Papua LNG Project benefit streams

The Papua LNG Project's benefit streams will include direct payments to the State of Papua New Guinea, and the provincial and local level governments.

The Papua LNG Project's **statutory benefits** include:

- Royalty payments
- Equity dividends provided the Government of Papua New Guinea acquires an equity share in the Project, that are to be distributed by the State to landowners.

ExxonMobil is committed to enhancing sustainable economic development through strategic community investment. ExxonMobil will continue to contribute to programs that focus on health, education, livelihood support programs, law and justice, environment, and civic and community support across the Project's life.

13.1.2.5 Project construction and operation activities

Chapter 2 Project Description provides a detailed description of the Project's construction and operation activities. Table 13.2 summarises the specific activities that have been identified as having the potential to result in social impacts and are referenced as the potential mechanisms of change in sections 13.1.3 and 13.1.4.

Table 13.2 Project construction and operation activities that may result in social impacts

Activity	Description
Expansion of marine offloading facilities	Installation of a catenary anchor leg mooring (CALM) buoy, similar to the Kumul Marine Terminal CALM buoy design, will delink the non-LNG liquids (naphtha and condensate) from LNG offloading at the existing berth. The CALM buoy will require a second shipping channel, additional navigational and monitoring systems, and approximately 7 km of dual subsea pipelines for the naphtha and condensate located to the south of the existing LNG Plant jetty. The construction of the subsea pipelines is not assessed in this EIS (refer to the Papua LNG Project – Upstream component); however, the operation is. A 500-m-radius exclusion zone will be required for the CALM buoy, including all vessels approaching during operation.
Marine exclusion zone	The current 500-m-radius marine exclusion zone (operational safety exclusion zone) for the LNG Plant jetty will remain in place and exclusion zones will be added for the CALM buoy. The new 500-m-radius exclusion zones will be centered at the CALM buoy (see Figure 2.2). A 1,200-m exclusion zone from the CALM buoy will apply during offloading which will be approximately four days per month. An approximate 1,650-m-radius 'hazard to navigate zone' will also be in place to signify that caution is required; however, public vessel access will not be restricted between the 1,200 m and 1,650 m radius areas. No public vessels will be allowed within the navigation channel during

Activity	Description
	approach and departure activities which will occur for four hours every three days for LNG carriers and four hours twice a month for condensate cargos. These zones will remain in place during construction, operation and decommissioning.
Expansion of the LNG Plant	The existing berth at the LNG Plant jetty provides a platform that allows LNG from the storage tanks to be loaded onto LNG carriers. The berth currently manages an estimated 110 to 120 LNG carriers (based on 164,000 m³ LNG carriers) and 10 to 12 naphtha tankers at the berth annually. The expansion of the LNG Plant will allow for an increase in ship traffic, with approximately 60 to 70 additional LNG carriers and 10 to 12 additional condensate cargos per year. The existing naphtha loading arm on the LNG Plant jetty will be replaced with a new LNG loading arm, as all the naphtha and condensate will be exported to the CALM Buoy.
Upgrading and use of Lea Lea Road	Most construction materials will be imported by ship via Motukea Port and trucked to site on the Lea Lea Road. To support this activity, it is anticipated that the Lea Lea Road will require repairs and upgrades, including relocating overhead cables to accommodate heavy and overweight vehicles and the transport of large modules. Transport of construction and operation personnel from Port Moresby will also occur along this road. The main entrance to the LNG Plant site may also be upgraded, as will the existing bypass road outside the fence between Gate 1 and Gate 3 (see Plate P015, Chapter 2 Project description). Construction of the bypass road is anticipated to begin during the fourth quarter of 2023 and continue into 2024. An estimated 200,000 tonnes of cargo are expected to be imported through Motukea Port over the four-year construction period. The bulk of the cargo will be shipped and transported to the LNG Plant site in the second year of construction (with a conservative peak of approximately 100,000 tonnes in quarter four of year two, though notably less during other periods) and moved by truck along the Lea Lea Road each month, with a peak of approximately 500 truck movements per month. Heavy haul of modules and other large equipment such as compressor packages and gas turbine generators will require approximately 20 movements over a period of approximately three months.
Construction of new flare system	The current flare system at the LNG Plant consists of a wet (hot) flare system, dry (cold) flare system and tankage (low-pressure) gas flare system. The low-pressure gas flare system will provide pressure relief for the LNG storage tanks and the boil-off gas system. New cold (dry) and hot (wet) flare systems, with the same configuration as the existing systems, will be provided to support the new trains, located to the east of the existing flare stack. The flares will be designed to provide smokeless flaring over a maximum range of operation, and all flare headers will be continuously purged with low-pressure fuel gas.

13.1.3 Potential social impacts on the national and provincial study area

This section describes the Project's potential social impacts at the national and provincial level. Each impact is described by identifying:

- The attribute of the social value that may be affected by the Project
- The mechanism of change
- The potential social impact
- The proposed mitigation measures

- The residual social impact following the successful implementation of mitigation measures.

Impacts have been grouped according to the potentially impacted social attribute. The attributes of the social value are described to provide context for the assessment of their underlying sensitivity.

Potential social impacts at the national and provincial level include potential impacts on:

- Social value 2: Availability of opportunities for participation in the cash economy.
- Social value 4: An environment supportive of personal, family and community health, safety, security and social wellbeing.

No impacts to the other social values were identified at the national and provincial level. Therefore, they are not considered further in this section.

13.1.3.1 Social value 2: Availability of opportunities for participation in the cash economy

This section considers how the Project's activities may provide opportunities to participate in the cash economy concerning:

- Engagement in the formal employment market
- Engagement in enterprise-based activities.

Engagement in the formal employment market

Livelihoods in Port Moresby are based on participation in government and private sector service enterprises, with the majority of participation in informal economic activity². While formal wage employment is nominally secure, remuneration levels are not high and many formal sector workers also participate in the informal sector. The existence of up to 40,000 low-skilled young people with little prospect of formal sector employment indicates highly precarious livelihoods that are only made viable by cooperation with extended family or clan units. Therefore, private-sector employment is valued, and the underlying sensitivity of opportunities for engagement in the formal employment market has been rated as **sensitive**.

There is a range of challenges for women to engage in formal employment in the resources sector, with MacIntyre (2011) noting the following in regard to mining projects, although the same issues are easily applied to the oil and gas context of the Project:

The difficulties that women face in getting the education and training that enables them to gain employment in mining projects are multiple and reinforce each other. The reasons for this are complex: a mixture of gender ideologies that are compounded by poverty; a lack of government commitment to the education sector; a subsistence economy that depends on female labour; and a lack of sex education and services for family planning (many secondary school students leave education because they become pregnant).

More recent commentary has noted that although the resource extraction boom (of which the PNG LNG Project was a large contributor) created new 'training and employment pathways for women...various local and workplace constraints and risks still limit female employment and retention' (Gotzmann, and Bainton 2019). The constraints identified in recent literature (Sharp *et al.* 2015; Gotzmann, and Bainton 2019; Filer 2021) note that the broader cultural issues remain largely unchanged from those identified by MacIntyre (2011), although with a greater emphasis on the challenge for women retaining employment. Specifically, there is now a recognition of the challenge of the 'double shift' for women who are expected to 'maintain their customary roles in the subsistence economy, as well as in child care' (Filer 2021) in addition to their 'shift' at a

² Informal economic activity refers to small-scale enterprises selling, producing or manufacturing goods regularly in prescribed or un-prescribed areas, such as streets or roadsides (Kavan 2010).

formal employer. Due to these challenges for women retaining employment opportunities, the underlying sensitivity of the availability and accessibility of employment opportunities in the formal market for women has been rated as **very sensitive**.

Mechanism of change

As detailed in Section 13.1.2, the Project is anticipated to require a construction workforce of between 5,000 and 7,000 full-time equivalent positions over the planned four-year construction period. The permanent operation workforce at the LNG Plant is expected to increase by approximately 50 technicians with support staff to increase.

Potential social impact

The Project's construction will provide opportunities for formal employment through direct, indirect, and induced employment. Direct employment refers to the Project's workforce detailed above. Indirect employment refers to the jobs that provide the goods and services needed to support the Project's workforce (Voigt-Graf and Odhuno 2019). Induced employment refers to the jobs created from the spending of wages and other income earned by the Project's workforce and have not been quantified. Although the Project's potential indirect and induced employment has not been quantified through modelling for this EIS, it can be assumed that there will be sufficient indirect and induced employment to result in a material increase in employment during the Project's construction. For example, research by Bainton and Jackson (2020) found that in 2014, the oil and gas industry generated 1.5 times greater employment in Papua New Guinean companies than that directly employed by oil and gas companies. This indicates that the employment requirements of the Project will have a noticeable impact on the availability of opportunities for formal employment.

Employment opportunities will be concentrated in the short to moderate term over the Project's construction period. The nature of LNG Plant construction means that there are often multiple activities undertaken in a semi-sequential process, which can result in short employment periods. For example, most site preparation activities must be completed before civil works are undertaken.

As detailed in Section 13.1.2, Papua New Guinean citizens will be prioritised for employment based on the following priority order:

1. From within the representative landowner companies' area
2. From the overall provincial area (i.e., the Central Province)
3. From outside of the provincial area, including the NCD.

Overall, the Project's construction is expected to increase wage-based employment opportunities within the provincial area and the NCD. Based on EMPNGA's understanding of the technical and vocational skills within the Papua New Guinean labour market, it is anticipated that around 20% of the construction workforce will be drawn from Papua New Guinea, with an ambition to increase through the National Content Plan. This equates to an anticipated peak of between 1,000 and 1,400 persons from Papua New Guinea, consistent with the PNG LNG Project where approximately 25% of the overall construction workforce was from the Papua New Guinea labour market.

National employment is complicated by a number of factors, including:

- There are a number of other large-scale projects and expansions of existing projects that may be developed in the Project's timeframe, which may reduce the availability of national resources for this Project.
- The Project's construction timeframe generates demand for a short-term workforce. This level of demand will likely outstrip the available skills and experience in the existing market.

Overall, employment during the construction period will be short to moderate term, and in the order of between 1,000 and 1,400 persons from Papua New Guinea in terms of direct employment. Consequently, the

magnitude of the increased opportunities to participate in wage-based employment during the Project's construction is expected to be medium, resulting in a potential impact with a **moderate significance**, as shown in Table 13.21.

As detailed above, the Project's operation is expected to result in an increased operational workforce of around 50 operations and maintenance technicians, with support staff anticipated to increase. A proportion of this workforce is expected to be drawn from the national and provincial study area. Although the number of jobs available is substantially lower than those available during construction, employment opportunities will be long-term. Consequently, the magnitude of the increased opportunities to participate in wage-based employment during the Project's operation is expected to be low, resulting in a potential impact with a **moderate significance**, as shown in Table 13.21.

Project-based employment will result in skills development for those employed through on-the-job training and experience working on a large-scale oil and gas sector project. The level of skill development will vary and will be dependent on the length and type of employment with the Project. A greater number of persons will experience skill development from employment during construction, although the level of skill development from short-term employment for the Project's construction will be minor. Consequently, the magnitude of the Project's potential impact on skill development within the province and NCD during construction is expected to be low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

During operation, there will be a much smaller number of persons employed by the Project; however, employment will be for longer terms, and the opportunities for training and skill development will be enhanced. EMPNG has a longstanding commitment to developing the capacity of the Papua New Guinean workforce, which is formalised through supporting the Kumul Petroleum Academy. ExxonMobil will use the Kumul Petroleum Academy to provide training to technician and operator personnel. Overall, the magnitude of the Project's potential impacts on skill development within the province and the NCD is expected to be medium, resulting in a potential impact with a **moderate significance**, as shown in Table 13.21.

All employment-related impacts (i.e., during construction and operation) are expected to be highly gendered, with the majority of the workforce being male. By way of example, between 2018 and 2021, women made up between 17% and 20% of the PNG LNG workforce. This gendered employment pattern is consistent with a broader social challenge in Papua New Guinea in accessing and retaining employment for women, as discussed above. Therefore, it is expected that the Project's employment will continue to be highly gendered, resulting in significantly fewer women participating in the Project's opportunities. Consequently, the magnitude of the Project's employment of women is expected to be low, resulting in a potential impact with a **moderate significance**, as shown in Table 13.21.

Mitigation and management measures

The measures proposed to enhance the Project's potential impacts on opportunities to participate in the cash economy in the national and provincial study area through formal employment and the management plan that these measures will be incorporated are summarised in Table 13.3.

Table 13.3 Availability of opportunities for engagement in the formal employment market

Potential impact	Mitigation and management measures
Improved opportunities for wage-based employment during construction and operation	The National Content Plan includes measures to promote the employment and skill development of Papua New Guineans during the Project's construction and operation. These measures include:

Potential impact	Mitigation and management measures
Improved opportunities for skill development during construction and operations	• Contractors will be required to develop and implement a recruitment plan, which will include monitoring the point of origin of all workers based on the geographic priority areas. • The EPC contractor will identify anticipated workforce requirements and develop relevant training plans based on these. Training will be developed through the following pre-defined training areas: ○ Project site induction training, which will be developed by Project contractors to adequately enable the efficient and safe operation of the worksite. ○ Basic skills introductory craft skills training, which will be developed and conducted by the contractors to develop soft skills and job-specific skills of the basic-skilled workforce. The training will be designed so that individuals that complete the training plus on-the-job training can be certified according to recognised standards in PNG. ○ Relevant on-the-job skills training, which contractors will develop to enable workers to gain official technical certificates through a recognised certification body. ○ Project and contractor-led semi-skilled training, which the Project will develop through identifying and working with training facilities to develop curricula and the capacity to deliver relevant semi-skilled craft training. In addition, Contractors will be expected to establish temporary programs tailored to the work packages or leverage existing programs to meet Project standards. ○ Demobilisation career planning, which will be developed by the contractor to effectively demobilise Papua New Guinean personnel from Project-related employment, including proof of employment, training and certifications, and potential employment with other large infrastructure projects. The demobilisation plans will account for preparing workers for large layoffs after peak construction. ○ Internships, which will be established by contractors, and by ExxonMobil in its organisation, are planned to be established in collaboration with Papua New Guinea's higher education institutions, to provide recent graduates with practical knowledge and experience. • ExxonMobil will work with TAFE-delivered Vocational Education and Training to support the development of the construction and operational workforce. • ExxonMobil will deploy training for operational roles through in-house training, on the job training, and externally delivered courses.
Improved opportunities for wage-based employment for women.	• ExxonMobil and contractors will develop recruitment practices that promote the employment of women. Contractors will include measures that address the recruitment of women in the recruitment plans and monitor and report to ExxonMobil on the employment of women. • ExxonMobil will provide educational and training opportunities and support for women, through: ○ Continuing to support the scholarship program with the Business and Professional Women's Club, and specifically, the Decie Autin Engineering Scholarship, which supports women to undertake engineering studies. ○ Continuing to support the Women in Energy Network, which is an ExxonMobil-led initiative that was established to support and encourage professional growth in women working with ExxonMobil.

Potential impact	Mitigation and management measures
	• EMPNGA and NLOC will continue to support broader initiatives to support women's economic advancement and workforce participation in Papua New Guinea, through: ○ Continuing to support the PNG Women's Forum, which contributes funding to improve national policy affecting women in Papua New Guinea. ○ Continuing working with the Business Coalition for Women, which works to enhance positive change for women and businesses in Papua New Guinea. ○ Continuing to support Papua New Guinean women to attend the Global Women in Management training program through the ExxonMobil Women's Economic Opportunity Initiative. ○ Continuing to support the Advancing PNG: Women Leaders Network, which supports the Papua New Guinean Global Women in Management alumni.

Residual impact assessment

The Project's potential impacts on opportunities to participate in the cash economy through formal employment are expected to be maximised through measures within the National Content Plan that are designed to increase overall Papua New Guinean participation and increase formal and informal skill development for those who participate, which are expected to contribute to long-term skill development for a substantial cohort of Papua New Guineans. Similarly, the measures identified are expected to support the recruitment and employment of women, noting that EMPNG has achieved a 20% proportion of female representation in existing operational activities. Consequently, the Project's potential impacts on opportunities to participate in the cash economy through formal employment are rated as follows and summarised in Table 13.21:

- The magnitude of the increased opportunities to participate in wage-based employment during the Project's construction are expected to increase from **medium to high**, resulting in a potential impact with a **high significance**.
- The magnitude of the increased opportunities to participate in wage-based employment during the Project's operation are expected to increase from **low to medium**, resulting in a potential impact with a **moderate significance**.
- The magnitude of the Project's potential impact on skill development during construction is expected to increase from **low to medium**, as it is assumed that the measures contained within the National Content Plan will maximise the opportunity for formal and informal skill development, resulting in a potential impact with a **moderate significance**.
- The Project's potential impacts on skill development during operation is expected to increase from **medium to high**, resulting in a potential impact with a **high significance**.
- The Project's potential provision of increased opportunities for women to participate in formal employment during the Project's construction and operation is expected to increase from **low to medium**, resulting in a potential impact with a **high significance**.

All potential impacts on opportunities to participate in the cash economy through formal employment are positive impacts.

Engagement in enterprise-based activities

There is an established contracting sector in Papua New Guinea that provides services to the mining and oil and gas sectors. Due to the importance of engagement opportunities in enterprise-based activities for the livelihoods of Papua New Guinean suppliers, the underlying sensitivity for these activities has been rated as **sensitive**.

Mechanism of change

The Project's construction will involve a range of goods and services that will be delivered through contractors, as detailed in Section 13.1.2. The Project's operation will continue to require a range of goods and services that will be delivered through contractors; however, the level of demand will be significantly reduced from that required during construction.

Potential social impact

The Project's construction will generate opportunities for contracting with Papua New Guinean suppliers. Based on EMPNGA's understanding of the Papua New Guinean market and the Project's likely construction activities, it is anticipated that there will be material opportunities for Papua New Guinean suppliers during construction, including but not limited to suppliers in the following sectors:

- Metallic and non-metallic pipe, fitting, and valves
- Fabricated metallic and non-metallic products and parts and workforce supply
- Shipping, receiving, logistics, and warehousing
- Safety and security services
- Real estate services
- Short-term accommodation
- Design and construction of buildings
- Utilities
- Facilities management
- Catering services
- First aid and clinical services
- Land transportation
- Surface treatments
- Professional and consulting services.

Although it is difficult to quantify the likely level of contracting opportunities that the Project will provide, the demand is expected to be noticeable. However, as has been noted by the World Bank (2016), there can be challenges in maximising in-country spend for oil and gas development projects in developing countries due to the specialised nature and technological complexity of some inputs. This, when coupled with high demand over a short term, limits the capacity of a developing economy to respond and take advantage of supply opportunities. In addition, while firms may have the qualifications and experience to tender for expected Project scopes, access to capital for Papua New Guinean firms can be challenging, which can limit an enterprise's activities to access growth opportunities.

Overall, the magnitude of the potential increased demand for enterprise-based services from Papua New Guinean suppliers during construction is expected to be low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

The Project's operation will continue to require goods and services that will continue to provide opportunities for contracting for Papua New Guinean suppliers. Based on EMPNGA's understanding of the Papua New Guinean market and the Project's likely operation activities, it is anticipated that there will be material opportunities for Papua New Guinean suppliers during operations, including but not limited to suppliers seen during construction as well as in the following sectors:

- Marine works
- Short-term accommodation
- Real estate services
- Catering services.

However, as noted above, the level of demand will be substantially reduced from that required during construction.

The PNG LNG Project engaged 110 Papua New Guinean companies in 2020, the contracts of which were worth around 460 million PGK (EMPNG 2022b). These figures exclude landowner companies, which are discussed in Section 13.1.4.2. Based on this, the Project is expected to continue to support Papua New Guinean businesses over the Project's life. The magnitude of the potential increased demand for enterprise-based services from Papua New Guinean suppliers during operation is expected to be low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

ExxonMobil is committed to the ongoing development of Papua New Guinean suppliers in line with the requirements of the *Oil and Gas Act 1998*. Pursuant to global best practices, the PNG LNG Project established the Institute of Banking and Business Management Enterprise Development Centre (Enterprise Centre) to provide capacity building for micro, small and medium enterprises. Today, the Enterprise Centre is independent of the PNG LNG Project and provides business assessment services, business advisory and mentoring services, and assists in developing the capacity of businesses, such as through gaining ISO 9001 accreditation. Since its establishment, the Enterprise Centre has completed over 600 business assessments, the equivalent of more than 46,500 training days and mentoring for some 20,000 entrepreneurs. EMPNG's work with the Enterprise Centre has supported the development of landowner companies along with Papua New Guinean businesses, such as Nares Engineering Limited and Total Waste Management, which have both become internationally certified businesses. The Project will work with the Enterprise Centre and work with Papua New Guinean businesses over the Project's life. Overall, the magnitude of the potential increases in the capacity of Papua New Guinean enterprises is expected to be low, resulting in a potential impact with a **low significance**.

The development of the PNG LNG Project resulted in workforce draw from a range of related industries, such as the construction and manufacturing sector, in addition to 'unrelated' industries, such as education and healthcare (Voigt-Graf and Odhuno, 2019). This workforce draw was attributed to the higher wages offered by employment within the PNG LNG Project (Voigt-Graf and Odhuno, 2019). The Project's construction will require a significant workforce during the construction phase, and consequently, the Project's workforce requirements have the potential to result in workforce draw from other sectors and contribute to a temporary skill shortage for other sectors. Changes to the availability of skilled workers will be short-term to medium-term, in line with the availability of employment (see Section 13.1.2) and coincide with peaks in employment demand. It is expected that these changes will affect discrete portions of the community and that the changes will be noticeable. Overall, the magnitude of the potential changes in the availability of skilled workers is expected to be low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

Management measures

The measures proposed to manage and enhance the Project's potential impacts on opportunities to participate in the cash economy through enterprise-based activities and the management plan that these measures will be incorporated are summarised in Table 13.4.

Table 13.4 Availability of opportunities for engagement in enterprise-based activities

Potential impact	Mitigation and management measures
Improved opportunities for enterprise-based activities during construction and operation.	The National Content Plan includes measures to promote the participation of Papua New Guinean suppliers during the Project's construction and operation. These measures include: • A commitment to use and purchase Papua New Guinean goods and services wherever they are comparable to foreign-sourced suppliers in terms of cost, availability, quality, and are specification compliant.
Increased capacity of enterprises.	• Contractors will be required to develop National Content Plans that will identify what goods and services are required for the work package, where Papua New Guinean-owned companies could participate, and how the contractor will increase the participation of these companies. • Work with the Enterprise Centre to support the Project through: ○ Undertaking a non-technical assessment of Papua New Guinean business capacity gaps considering the Project's anticipated needs to inform the development and delivery of business training courses. ○ Supplier outreach and registration, including the launch of a supplier management portal platform. The supplier management portal will allow for Papua New Guinean businesses to register, and pre-verify their credentials, and receive procurement notices, and other Project communications. ○ Contractors will be required to utilise the Centre's supplier management portal for the dissemination of contracting opportunities. • The Project will engage with relevant industry stakeholders directly and through the Enterprise Centre to provide information about the status of the Project and National Content progress. • The Project will encourage the Enterprise Centre to identify through its member banks ways to improve access to finance for Papua New Guinean suppliers, including through industry engagement and education.
Reduced availability of skilled workforce for other industries.	The National Content Plan includes measures to promote the employment and skill development of Papua New Guineans during the Project's construction and operation. These measures include: • The EPC contractor will identify anticipated workforce requirements and develop recruitment and training plans based on these. Training will be developed through the following pre-defined training areas: ○ Project site induction training, which will be developed by Project contractors to adequately enable the efficient and safe operation of the worksite. ○ Basic skills introductory craft skills training, which will be developed and conducted by the Contractors to develop soft skills and job-specific skills of the basic-skilled workforce. The training will be designed to support individuals that complete the training plus on-the-job training can be certified according to recognised standards in PNG. ○ Relevant on-the-job skills training through the development of each semi-skillset grouping, which Contractors will develop to enable workers to gain official technical certificates through an internationally recognised certification body. ○ Project and contractor-led semi-skilled training, which the Project will develop through identifying and working with training facilities to develop curricula and the capacity to deliver relevant semi-skilled craft training. In addition, contractors will be expected to establish temporary programs tailored to the work packages or leverage existing programs to meet Project standards. ○ Demobilisation career planning, which will be developed by the contractor to effectively demobilise Papua New Guinean personnel from Project-related

Potential impact	Mitigation and management measures
	employment, including proof of employment, training and certifications, and potential employment with other large infrastructure projects. The demobilisation plans will account for preparing workers for large layoffs after peak production. ○ Internships, which will be established by Contactors in collaboration with Papua New Guinea's higher education institutions, to provide recent graduates with practical knowledge and experience. ○ ExxonMobil will continue to undertake training for operational roles through in-house training, on the job training, and externally delivered courses.

Residual impact assessment

The measures in the National Content Plan are expected to expand on the learnings from the PNG LNG Project, and maximise the identification, participation, and development of Papua New Guinean enterprises and contribute to the broader formal and informal skill development of the participating workforce. Consequently, following the implementation of mitigation and management measures, the Project's potential impacts on opportunities to participate in enterprise-based activities are rated as follows and summarised in Table 13.21:

- The magnitude of the potential increased demand for enterprise-based services from Papua New Guinean suppliers during construction is expected to increase from **low to medium**, resulting in a potential impact with a **moderate significance**.
- The magnitude of the potential increased demand for enterprise-based services from Papua New Guinean suppliers during operation, is expected to increase from **low to medium**, resulting in a potential impact with a **moderate significance**.
- The magnitude of the potential increases in the capacity of enterprises within Papua New Guinea is expected to increase from **low to medium**, resulting in a potential impact with a **moderate significance**.
- The magnitude of the potential changes in the availability of skilled workers is expected to remain **low**, resulting in a negative impact with a **low significance**. Although the measures in the National Content Plan will support the identification of the Project's skills requirements and support training of this workforce, a certain level of workforce draw is expected to occur regardless of the implementation of management measures, and consequently, the magnitude of the potential impact remains unchanged.

All potential impacts on opportunities to participate in enterprise-based activities are positive, with the exception of the potential changes in the availability of skilled workers, which is a potential negative impact.

13.1.3.2 Social value 4: An environment supportive of personal, family and community health, safety, security and wellbeing

This section considers how the Project's activities may impact on qualities in the social environment that are supportive of personal, family and community health, safety, security, and wellbeing. The attributes that contribute to this social value that may be affected by the Project, directly or indirectly, include the community's access to housing and accommodation within the National Capital District.

Housing and accommodation

Considerable housing development has occurred in Port Moresby in the last decade, much of this targeted at the high-end of the housing sector. As of November 2022, it is understood that there is a reasonable level of vacancies within Port Moresby at the higher end of the market, which has been attributed to an increase in supply and a reduction in demand due to the completion of several large projects and impacts of pandemic

measures. Although the supply of housing has increased and the cost has reduced since highs experienced during the construction of the PNG LNG Project, the overall cost of housing remains inflated and above that of housing prior to the development of the PNG LNG Project. Consequently, the majority of formal housing is unaffordable for Papua New Guineans, including those who are employed within the formal sector. The underlying sensitivity of the affordability of the housing market has been rated as **sensitive**.

Mechanism of change

The Project will require a construction workforce of between 5,000 and 7,000 full-time equivalent positions over the planned four-year construction period. The permanent operations workforce at the integrated LNG Plant is expected to increase by approximately 50 operations and maintenance technicians over current numbers, with support staff anticipated to increase.

Overall during construction, 20% of the construction workforce is estimated to be filled by Papua New Guineans, with ambition to increase this through the National Content Plan. The remaining positions are anticipated to be filled by expatriate staff. Typical hiring locations for expatriate staff include Australia, North America, and south-east Asia.

A relatively small number of the expatriate workforce will require accommodation within the Port Moresby housing market, or within the short-term accommodation market.

Potential social impact

The Project's demand on the formal housing market is expected to be limited as temporary accommodation camps will be constructed for company and contractor personnel. Consequently, the demand is likely to be accommodated within current vacancies. However, there is a potential that the market will react to the Project's construction and result in a temporary increase in prices (Farren 2014). Should this occur, there will be an increased reduction in affordability for residents in Port Moresby. It is expected that the size of the expatriate workforce, and the current availability of housing in this portion of the market will limit this effect. Similarly, it is expected that any potential impact on housing affordability by the Project will be limited in scale and restricted to the early stages of the Project's construction phase as the effect will be anticipatory rather than as a result of Project-induced demand. Overall, the magnitude of the potential changes in housing affordability is expected to be low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

Mitigation and management measures and residual impact assessment

Due to the low significance of the potential impact, no mitigation and management measures have been proposed. Consequently, there are no changes to the magnitude of the potential impact, and the residual significance of the Project's potential impact on the availability and affordability of housing in Port Moresby is **low**.

13.1.4 Potential social impacts on the LNG Plant study area

This section describes the Project's potential social impacts on communities within the LNG Plant study area. Each impact is described by identifying:

- The attribute of the social value that may be affected by the Project
- The mechanism of change
- The potential social impact
- The proposed mitigation measures
- The residual social impact following the successful implementation of mitigation measures.

Impacts have been grouped according to the potentially impacted social attribute. The attributes of the social value are described to provide context for the assessment of their underlying sensitivity.

13.1.4.1 Social value 1: the capacity to support livelihoods based on the harvest of natural resources

This section considers how the Project's activities may affect the capacity of communities within the LNG Plant study area to support livelihoods based on the use of natural resources. The attributes that contribute to this social value that may be affected by the Project, directly or indirectly, include the community's access to terrestrial and marine resources.

Availability of terrestrial resources for subsistence livelihoods

The livelihoods of communities within the LNG Plant study area were traditionally based on the use of natural resources. Traditional use of land and other terrestrial resources is important to communities within the LNG Plant study area, although the provision of food staples is constrained by poor soils and water scarcity. Responses to the family nutrition questions in the household survey indicate that subsistence gardening remains important to the study area residents but is highly dependent on seasonal factors (Appendix C Social Baseline).

Although access to cash wages has allowed some people to de-prioritise gardening, gardening is important for supporting people's livelihoods and household food security, with reported concerns about the availability of suitable land for gardening and theft being an issue raised during consultation undertaken for this study. Land disputes (arising due to positioning for compensation and royalty distribution from the PNG LNG Project, as well as population growth) were also raised as a common issue affecting both the availability and suitability of available land for gardening (Appendix C Social Baseline).

Due to the importance of terrestrial resource use for livelihoods within the LNG Plant study area, particularly as these resources support household food security, the underlying sensitivity of the availability of these resources has been rated as **very sensitive**.

Mechanism of change

As described in Section 13.1.2, the Project may result in the in-migration of people (PIIM) into the LNG Plant villages, particularly during the construction phase.

Potential social impact

Population growth and demand for land as a result of PIIM may reduce the availability of natural resources to support the livelihood of communities within the study area. Based on the trend demonstrated by the PNG LNG Project, the change in population due to anticipation of the Project's opportunities will likely be moderate-term and primarily focused on the Project's construction phase.

During the PNG LNG Project's construction, some PIIM occurred; however, monitoring indicated that the scale and rate of in-migration did not overwhelm the capacity of communities, or the services provided (PNG LNG 2015). Furthermore, PIIM monitoring indicated that in-migration was at its peak in LNG Plant communities prior to the construction of the PNG LNG Project, indicating that the in-migration was anticipatory (NewFields, 2017). It is expected that the scale of PIIM for the Project during construction will be similar, given the projected workforces are similar.³ Should PIIM occur at greater levels, there is a potential that there will be greater demand for terrestrial resources. For some households, the demand may exceed access to land or the capacity of the land available, resulting in potential adverse impacts on household livelihoods.

The potential impact of this will vary depending on the household and the level of reliance on terrestrial resources; for households that have limited access to cash incomes, the potential impact could result in predominantly short-term livelihood challenges. The effect is therefore expected to be limited to discrete sections of households within the LNG Plant communities. Consequently, the magnitude of the Project's

³ Although employment for the PNG LNG Project peaked at 21,200 in 2012, it is noted that the predicted peak published in the PNG LNG EIS was 7,500 see *Environmental Impact Statement PNG LNG Project: Chapter 7 Project Substantiation* (Coffey Natural Systems 2009).

potential impacts on the access to or capacity of terrestrial resources to support livelihoods during construction is expected to be low, resulting in a potential impact with a **moderate significance**, as shown in Table 13.21.

In addition to the PIIM that may occur during the Project's construction, there are broader and longer-term social processes resulting in in-migration to these communities, of which the PNG LNG Project has contributed to indirectly, and the Project will likely continue to contribute to, including:

- Broader development of the area around the LNG Plant, of which the PNG LNG Project was a catalyst (see Appendix D Traffic and Land Use); the development of the area along with its proximity to Port Moresby was noted by participants in consultation to have made the LNG Plant communities more attractive to in-migrants.
- Employment at the integrated LNG Plant, although it is noted that the operational workforce will increase by approximately 50 operations and maintenance technicians and associated support staff (Section 13.1.2.1).
- Amenity and services and perceived potential for improvement of these associated with the presence of the LNG Plant.
- Natural population growth.

These long-term processes of in-migration are expected to continue and will likely contribute to demand on terrestrial resources. The level of contribution from PIIM during operation is expected to be minor and to be indirect. For some households, the demand may exceed access to land or the capacity of the land available, resulting in potential adverse impacts on household livelihoods. This potential impact will vary depending on the household and the level of reliance on terrestrial resources; for households with limited access to cash incomes, the potential impact could result in long-term livelihood challenges.

Consequently, the magnitude of the Project's potential impacts on the access to or capacity of terrestrial resources to support livelihoods during operation is expected to be very low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

Mitigation and management measures

The measures proposed to mitigate and manage the Project's potential impacts on the capacity of terrestrial resources to support livelihoods and the relevant management plan that these measures will be incorporated are summarised in Table 13.5.

Table 13.5 Utilisation of terrestrial resources – management response

Potential impact	Mitigation and management measures
Reduced capacity of terrestrial resources to support livelihoods in LNG Plant communities due to population growth	The Project Induced In-migration Management Plan includes measures to limit in-migration. These measures include: • Minimising the incentive for in-migration through developing and communicating clear practices for recruitment, contracting, camp management and workforce accommodation, site access, and transport and logistics. • EMPNGA will work with key stakeholders and LNG Plant communities to identify community infrastructure and resources that may need additional support in each specific community due to the effects of PIIM. This may incorporate a range of actions as agreed with LNG Plant communities. • EMPNGA will work with key stakeholders and LNG Plant communities to: ○ Identify potential PIIM and work with key stakeholders (government and LNG Plant community leaders) and Project functions to create systems to deter PIIM.

Potential impact	Mitigation and management measures
	○ Promote stakeholders' involvement and management of PIIM impacts and opportunities. ● Develop PIIM indicators for monitoring and reporting across the Project's construction and where appropriate, operation. Where monitoring indicates that PIIM is an issue, EMPNGA will work with key stakeholders and LNG Plant communities to develop mitigation and management measures in line with the Project's contribution to in-migration processes. The Community Development Support Plan includes measures to support the diversification of livelihoods within LNG Plant communities. These measures may include: ● ExxonMobil will support sustainable livelihood diversification programs in consultation with government and non-government stakeholders. The programs will be identified and developed through needs-based assessments and community consultation and will aim to diversify and increase capacity in the LNG Plant villages through best practice techniques. Needs-based assessments and community consultation will take into account activities by men, women and youth, and access rights to areas of impact. ExxonMobil will undertake periodic monitoring of livelihoods within the LNG Plant communities across the Project's lifecycle to identify Project-related impacts community livelihoods and support the development of appropriate livelihood diversification programs.

Residual impact assessment

The mitigation and management measures identified in the Project Induced In-migration Management Plan are designed to firstly minimise the incentive for PIIM to occur. In turn, this is expected to reduce the demand on terrestrial resources that support livelihoods in LNG Plant communities, particularly during construction, when it is expected that PIIM will be at its highest, based on experience in these communities and in other resource development projects in Papua New Guinea. Despite these measures, it is recognised that a certain level of PIIM is likely to occur, particularly during the construction phase, and that there are broader and existing in-migration processes occurring in LNG Plant communities that the Project may contribute to directly and indirectly. These processes may continue to impact on the availability of terrestrial resources and impact on the livelihoods of some households. On this basis, it is expected that the measures included in the Community Development Support Plan will support the diversification of livelihoods will support those community cohorts most impacted through needs-based assessments.

Impacts to terrestrial resources during operation are expected to be associated with PIIM; however, PIIM during this phase is expected to be minor and indirect. Therefore, the primary management response will be to develop monitoring indicators to confirm this assessment. Consequently, the magnitude of the Project's potential impacts on the capacity of terrestrial resources to support livelihoods is rated as follows and summarised in Table 13.21:

- The magnitude of the Project's potential impacts on the capacity of terrestrial resources to support livelihoods during construction is expected to reduce from **low to very low**, resulting in a potential residual impact with a **low significance**.
- The magnitude of the Project's potential impacts on the capacity of terrestrial resources to support livelihoods during operation is expected to remain very low, with the potential residual impact remaining at a **low significance**. The potential residual impact does not change as the initial magnitude is very low and cannot be reduced further.

Availability and accessibility of marine areas for artisanal and subsistence fishing

Fishing and the gleaning of other marine resources (e.g., gathering of shells, mudcrabs, sea cucumber) is an important livelihood activity across all the LNG Plant villages. Fishing occurs across Caution Bay and out to the barrier reefs and open ocean. Results from the Caution Bay fisheries resource use study (Coffey 2020) show that between 2012 and 2019, the most common fishing location (aggregated for all villages) has shifted from the beach to the barrier reef and open sea.

As detailed in Appendix C Social Baseline, most surveyed households (approximately 65%) in all villages (but particularly in Boera and Lea Lea) indicated that the current fish catch was less than the fish catch five years previously. The Caution Bay fisheries resource use study (Coffey 2020) reported that catch rates (expressed as catch per unit effort) were generally consistent over the monitoring period of 2012 to 2014 and 2019. However, there is a perception within the fishing community that the existing marine project infrastructure such as the LNG jetty is attracting fish to an area that cannot be targeted by fishers due to the safety exclusion zone and therefore increasing the required fishing effort to maintain catch levels. Together, this data indicates a level of vulnerability regarding access to and the availability of marine resources to support livelihoods. In addition, fishing is recognised to have an important cultural element, particularly for the Motu (Wu, 2020); potential impacts to cultural identity and traditions are discussed further in Section 13.1.4.3. The underlying sensitivity of marine resource use for livelihoods has been rated as **sensitive** due to the importance of marine resources to communities within the study area.

Mechanism of change

The Project will require an additional 500-m-radius marine exclusion zone in Caution Bay to incorporate the new CALM buoy. The exclusion zone will be centered on the CALM buoy and the zone will remain in place during construction, operation and decommissioning.

The following exclusion zones will also be implemented during operation:

- A 1,200-m exclusion zone from the CALM buoy will apply during offloading, which will be approximately four days per month.
- A 1,650-m-radius 'hazard to navigate zone' will also be in place to signify that caution is required; however, public vessel access will not be restricted between the 1,200 m and 1,650 m radius areas.
- No public vessels will be allowed within the navigation channel during approach and departure activities which will occur for four hours every three days for LNG carriers and four hours twice a month for condensate cargos.

Potential social impact

The implementation of the new marine exclusion zone, installation of the CALM buoy and additional navigation channel may result in a number of social changes to livelihoods, including:

- A reduction in the accessibility of fishing grounds for artisanal and subsistence fishing
- A reduction in the availability of fishing grounds for artisanal and subsistence fishing.

The new 500-m radius marine exclusion zones associated with the CALM buoy will remain in place during construction and operation. This may reduce the accessibility of fishing grounds for artisanal and subsistence fishers, particularly those from Boera. Additionally, public vessel movements will be excluded from the secondary navigation channel for approximately 48 hours per month during vessel approach and departure activities. This may reduce the accessibility of fishing grounds for artisanal and subsistence fishers, particularly those from Papa. This may require fishers to travel further to avoid the Project's exclusion zone, increasing time and the costs associated with transit to access fishing grounds.

The Project's CALM buoy and associated marine exclusion zone and navigation channel will expand the area that cannot be used or otherwise accessed by fishermen. Although the area is limited, it may have a greater effect on those who have customary use of this area (and therefore may not have access to fishing in other

areas). The surveys undertaken to support the Caution Bay Fisheries Resource Use Study (Appendix L) did not find that there were any fishing sites within the exclusion zones (Figure 13.1), although it is recognised that this does not necessarily mean that the area is not used sporadically, particularly those from Boera or Papa which reported fishing sites nearby.

Overall, the potential impact on local fishers' capacity to support their livelihoods due to reduced availability and access to marine resources is likely to be limited to a small group of fishermen who use the area. The exclusion zone and navigational channel will be long-term (i.e., approximately 30 years), and may result in small but measurable changes for artisanal fishers affected, particularly given that the cost of fuel is the largest expense involved in subsistence and artisanal fishing (Goldman 2009). Overall, the magnitude of the potential impact to the capacity to support livelihoods is expected to be medium, resulting in a potential with a **moderate significance**, as shown in Table 13.21.

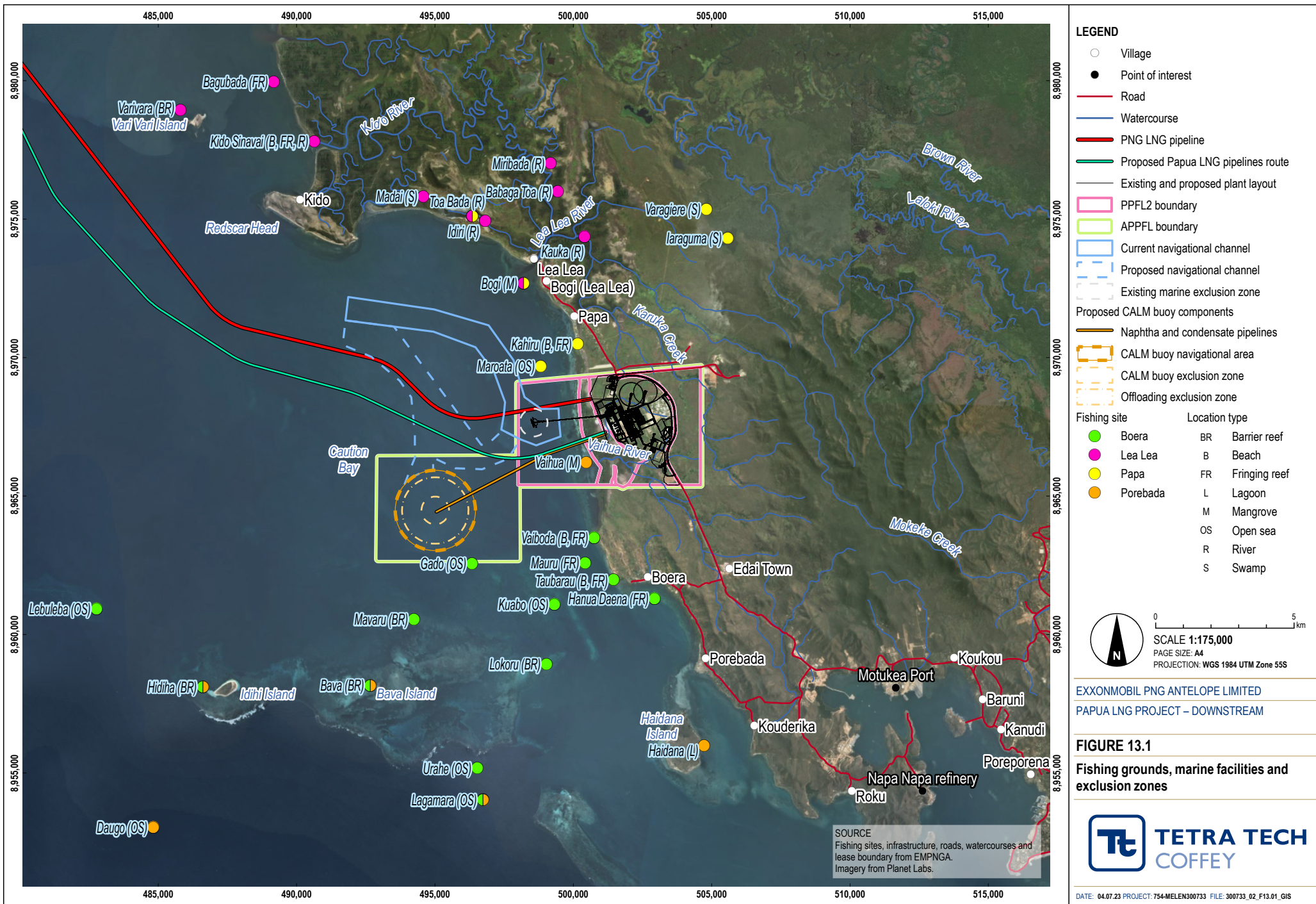
There is a perception within the fishing community that the existing marine project infrastructure (i.e., LNG Plant jetty) has attracted fish to an area that cannot be targeted by fishers due to the safety exclusion zone and is therefore increasing the required fishing effort to maintain catch levels, and potentially reducing fish stocks in other areas. The findings of the Nearshore Marine Baseline study (Appendix E) indicate that the establishment of the LNG Plant jetty has, over time, provided a relatively protected artificial habitat that presently supports several fish species that are likely to be targeted by local fishing activity, such as trevally, and surgeonfish. However, improvements in habitat within one area of Caution Bay are unlikely to reduce the overall fish stock within Caution Bay and instead are likely to support the overall fish stock in Caution Bay. Similarly, the Project's expansion of exclusion zones and marine project infrastructure may also result in an increase in the availability of artificial habitats that support fish species, and support fish stock levels within Caution Bay. Any benefit from this is expected to be marginal as there is no access to these areas for fishermen; consequently, this is not assessed further.

Mitigation and management measures

The measures proposed to mitigate and manage the Project's potential impacts on the availability of marine resources for livelihoods and the relevant management plan that these measures are incorporated within are summarised in Table 13.6.

Table 13.6 Availability of marine resources – management response

Impact	Mitigation and management measures
Reduced capacity to support livelihoods due to reduced availability and access to marine resources.	The Community Development Support Plan includes measures to manage the restriction of access to areas used for artisanal and subsistence fishing, including: - Supporting sustainable livelihood diversification programs in consultation with government and non-government stakeholders. The programs will be identified and developed through needs-based assessments and community consultation and will aim to diversify and increase capacity in the LNG Plant villages through best practice techniques. Needs-based assessments and community consultation will take into account activities by men, women and youth, and access rights to areas of impact. - Undertaking periodic monitoring of livelihoods within the LNG Plant communities across the Project's lifecycle to identify Project-related impacts community livelihood's and support the development of appropriate livelihood diversification programs.



Residual impact assessment

The Project's potential impacts on livelihoods due to reduced availability and access to marine resources are the product of exclusion zones that are designed to protect marine user safety but will result in a level of unavoidable change in the availability and accessibility of a small area. The measures in the Community Development Support Plan are designed to identify those most impacted by these changes through needs-based assessments and periodic monitoring and to develop appropriate livelihood diversification and support programs. Consequently, the Project's potential impacts on the availability of marine resources is rated as follows and summarised in Table 13.21:

- The magnitude of the potential reduction in capacity to support livelihoods due to reduced availability and access to marine resources is expected to reduce from **medium to low**, resulting in a potential residual impact with a **low significance**.

13.1.4.2 Social value 2: the availability of opportunities to participate in the cash economy

This section considers how the Project's activities may provide opportunities to participate in the cash economy in regard to:

- Engagement in the formal employment market
- Engagement in the informal economy
- Engagement in enterprise-based activities
- Direct payment of Project benefit streams (i.e., royalties and equity payments).

Regardless of the mechanism of change, each Project activity has the potential to result in increased personal and household income. The findings of the Social Baseline (Appendix C) indicate that household expenditure in the LNG Plant study area is focused on food, transport (fuel) and water and that it is common for household expenditure requirements to be beyond the household's income; for example, payday loans from family are common (colloquially termed as 'social security'), as are informal debt arrangements. Similarly, it was noted during consultation that medical costs can substantially impact households.

Overall, this indicates that opportunities to participate in the cash economy, or otherwise increase household income are highly valued within the LNG Plant communities. Increases in household incomes may have a range of flow-on social impacts, which, depending on personal and household choices, can be positive, such as increased access to and use of public services (Section 13.1.4.5), or adverse, such as increased use of alcohol (Section 13.1.4.4).

Engagement in the formal employment market

Studies undertaken in 2008 for the PNG LNG Project recorded that around 25% of households in the study area received income from employment (Coffey Natural Systems 2009). Responses to the household survey in 2019 demonstrate that this had increased to over 50% in all LNG Plant villages except Papa; although over a third of households in Papa reported that they received income from wages. Households surveyed in 2019 reported that around 30% received income from work associated with the presence of the LNG Plant, with approximately half of that being through Laba Holdings. Around 20% of surveyed households in all villages receive income from other private sector employment. Overall, this indicates that engagement in the formal employment market is an important and significant component of livelihoods within the LNG Plant area; therefore, the underlying sensitivity of opportunities for engagement in the formal employment market has been rated as **sensitive**.

As detailed in Section 13.1.3.1, there is a range of challenges for women in engaging in formal employment. Consequently, the underlying sensitivity of the availability and accessibility of employment opportunities in the formal market for women has been rated as **very sensitive**.

Mechanism of change

As detailed in Section 13.1.2, the Project will require a construction workforce of between 5,000 and 7,000 full-time equivalent positions over the planned four-year construction period. The permanent operations workforce at the integrated LNG Plant is expected to increase by approximately 50 operations and maintenance technicians, with a corresponding increase in support staff.

Potential social impact

As described in Section 13.1.3, the Project's construction will provide opportunities for formal employment through direct, indirect, and induced employment. As detailed in Section 13.1.2, Papua New Guinean citizens originating from within the representative landowner companies area will be prioritised for employment, followed by Papua New Guinean citizens from the overall provincial area, followed by Papua New Guinean citizens from outside of the provincial area.

Based on the experience of the PNG LNG Project (Oxfam 2011; Voigt-Graf and Odhuno 2019), and the low level of tertiary and technical education within the LNG Plant communities (Appendix C Social Baseline), it is anticipated that Papua New Guineans from within the representative landowner companies and the province will constitute the majority of the basic-skilled workforce.

Overall, the Project's construction is expected to increase wage-based employment opportunities within the LNG Plant communities. Although the quantum of employment opportunities is substantial compared to existing opportunities, it is not expected that every person in the LNG Plant communities that may seek employment will be employed due to the relatively low levels of technical and tertiary training within the LNG Plant communities. Consequently, the magnitude of the increased opportunities to participate in wage-based employment during the Project's construction are expected to be medium, resulting in a potential beneficial impact with a **moderate significance**, as shown in Table 13.21.

As detailed above, the Project's operation is expected to result in an increased operational workforce of around 50 operations and maintenance technicians above that currently employed at the LNG Plant for the PNG LNG Project, as well as an increase in support staff. Table 13.7 details the current operational breakdown of the PNG LNG workforce, which can be used as an indication of the structure of the expanded operational workforce required for the Project. As shown, approximately 91% of the overall workforce is Papua New Guinean. The Papua New Guinean national workforce can be further disaggregated into the following sources (EMPNG 2022b):

- Approximately 45% from the local area proximal to PNG LNG operation
- Approximately 25% from the province that the PNG LNG operations are located within
- Approximately 30% from other areas of Papua New Guinea.

The data from 2016 to 2021 demonstrates that there has been a trend of increased employment from the local and provincial areas, which likely reflects ongoing investment in education, training, and outreach by EMPNG and the Government of Papua New Guinea, along with the broader acquisition of skills in the LNG Plant communities, as discussed further below.

Overall, the Project's operation is expected to increase wage-based employment opportunities within the LNG Plant communities. The quantum of permanent employment is limited and given the skill profile within the LNG Plant communities, the level of employment from LNG Plant communities during operations is expected to be around 22 full-time equivalent positions (45%) given existing trends demonstrated by the PNG LNG Project (Table 13.7). Consequently, the magnitude of the increased opportunities to participate in wage-based employment during the Project's operation are expected to be medium, resulting in a potential impact with a **moderate significance**, as shown in Table 13.21.

Table 13.7 PNG LNG Project – operational workforce breakdown

Year	Workforce	% National	% provincial	% local	% women
2016	2,500	82	36	37	No data.
2017	2,580	82	31	40	No data.
2018	3,236	86	33	42	19
2019	3,964	86	33	50	17
2020	2,784	91	29	46	20
2021	3,339	89	25	45	19
Average	3,181	87	30	45	19

Source: EMPNG (2017, 2018, 2019, 2020, 2021, 2022b) PNG LNG Environmental and Social Report.

Project-based employment will likely result in skills development for those employed through on-the-job training and experience working on a large-scale oil and gas sector project. The level of skill development will vary and will be dependent on the length and type of employment with the Project. A greater number of persons will likely experience skill development from employment during construction, although the level of skill development from short-term employment for the Project's construction will be minor. Consequently, the magnitude of the Project's potential impact on skill development within the LNG Plant communities during construction is expected to be medium, resulting in a potential impact a **moderate** significance, as shown in Table 13.21.

The National Content Plan (EMPNGA 2023) developed for this Project will require Project contractors to develop a variety of training plans for qualified workers and to track on-the-job training progress. Under the National Content Plan contractors will be required to develop strategies that will utilise both in-country training academies as well as self-delivered by contractor on-site. Both on-the-job and short-term formal training will be offered to support workers to gain official technical certificates. During operation, there will be a much smaller number of persons employed by the Project; however, employment will be for longer terms, and the opportunities for training and skill development will be enhanced. As discussed previously, EMPNG has an established relationship with the Kumul Petroleum Academy and has sponsored trainees to complete the Academy's training program. ExxonMobil will support the Kumul Petroleum Academy and pursue the skill development of Papua New Guineans, including people from within the LNG Plant communities. Overall, the Project's potential impact on skill development within the LNG Plant communities is expected to be medium, resulting in a potential impact with a **moderate significance**, shown in Table 13.21.

As was detailed for employment opportunities in the national and provincial study area (Section 13.1.3.1), all potential employment-related impacts (i.e., during construction and operation) are expected to be highly gendered, with the majority of the workforce being male. Consequently, the magnitude of the Project's employment of women is expected to be low, resulting in a potential with a **moderate significance**, as shown in Table 13.21.

Mitigation and management measures

The measures proposed to enhance the Project's potential opportunities to participate in the cash economy and the management plan that these measures will be incorporated are summarised in Table 13.8.

Table 13.8 Availability of opportunities for engagement in the formal employment market

Potential impact	Mitigation and management measures
Improved opportunities for wage-based employment.	The National Content Plan includes measures to promote the employment and skill development of Papua New Guineans during the Project's construction and operation. These measures include: - Contractors will be required to develop and implement a recruitment plan, which will include monitoring the point of origin of all workers based on the geographic priority areas. - The EPC contractor will identify anticipated workforce requirements and develop relevant training plans based on these. Training will be developed through the following pre-defined training areas: - Project site induction training, which will be developed by Project contractors to adequately enable the efficient and safe operation of the worksite. - Basic skills introductory craft skills training, which will be developed and conducted by the contractors to develop soft skills and job-specific skills of the basic-skilled workforce. The training will be designed so that individuals that complete the training plus on-the-job training can be certified according to recognised standards in PNG. - Relevant on-the-job skills training, which contractors will develop to enable workers to gain official technical certificates through a recognised certification body. - Project and contractor-led semi-skilled training, which the Project will develop through identifying and working with training facilities to develop curricula and the capacity to deliver relevant semi-skilled craft training. In addition, Contractors will be expected to establish temporary programs tailored to the work packages or leverage existing programs to meet Project standards. - Demobilisation career planning, which will be developed by the contractor to effectively demobilise Papua New Guinean personnel from Project-related employment, including proof of employment, training and certifications, and potential employment with other large infrastructure projects. The demobilisation plans will account for preparing workers for large layoffs after peak production. - Internships, which will be established by contractors, and by ExxonMobil in its operating organisation, are planned to be established in collaboration with Papua New Guinea's higher education institutions, to provide recent graduates with practical knowledge and experience. - ExxonMobil will continue to work with TAFE-delivered Vocational Education and Training to support the development of the construction and operational workforce. - ExxonMobil will continue to undertake training for operational roles through in-house training, on the job training, and externally delivered courses.
Improved opportunities for skill development during construction and operations.	
Improved opportunities for wage-based employment for women	- ExxonMobil and contractors will develop recruitment practices that promote the employment of women. Contractors will include measures that address the recruitment of women in the recruitment plans and monitor and report to ExxonMobil on the employment of women. - ExxonMobil will provide educational and training opportunities and support for women, through: - Continuing to support the scholarship program with the Business and Professional Women's Club, and specifically, the Decie Autin Engineering Scholarship, which supports women to undertake engineering studies. - Continuing to support the Women in Energy Network, which is an ExxonMobil-led initiative that was established to support and encourage professional growth in women working with ExxonMobil.

Potential impact	Mitigation and management measures
	• EMPNGA and NLOC will continue to support broader initiatives to support women's economic advancement and workforce participation in Papua New Guinea, through: ○ Continuing to support the PNG Women's Forum, which contributes funding to improve national policy affecting women in Papua New Guinea. ○ Continuing working with the Business Coalition for Women, which works to enhance positive change for women and businesses in Papua New Guinea. ○ Continuing to support Papua New Guinean women to attend the Global Women in Management training program through the ExxonMobil Women's Economic Opportunity Initiative. ○ Continuing to support the Advancing PNG: Women Leaders Network, which supports the Papua New Guinean Global Women in Management alumni.

Residual impact assessment

Measures within the National Content Plan are designed to increase the participation of LNG Plant communities in employment opportunities, and increase formal and informal skill development for those who participate. Similarly, it is expected that measures to support employment during construction and operation will increase women's participation in employment opportunities, which is highly valued by women in LNG Plant communities, albeit it is acknowledged that there are cultural challenges in recruiting and retaining women. Consequently, the Project's potential impacts on opportunities to participate in the cash economy in the LNG Plant study area communities are rated as follows and summarised in Table 13.21.

- The magnitude of the increased opportunities to participate in wage-based employment during the Project's construction are expected to increase from **medium to high**, resulting in a potential impact with a **high significance**.
- The magnitude of the increased opportunities to participate in wage-based employment during the Project's operation are expected to increase from **medium to high**, resulting in a potential beneficial impact with a **high significance**.
- The magnitude of the Project's potential impact on skill development during construction is expected to increase from **medium to high**, resulting in a potential impact with a **high significance**.
- The Project's potential impact on skill development during operation is expected to increase from **medium to high**, resulting in a potential with a **high significance**.
- The magnitude of the increased opportunities for the employment of women is expected to increase from **low to medium**, resulting in a potential with a **high significance**.

All potential impacts on opportunities to participate in the cash economy through formal employment are positive impacts.

Engagement in the informal economy

Papua New Guinea has a dual economy comprising a formal economy and an informal economy. The findings of the social baseline study (Appendix C Social Baseline) indicate that a substantial portion of household income is generated through a range of activities within the informal economy, including:

- Operating public motor vehicle services (PMVs).
- The operation of market stalls selling a range of items, including betel nut (*buai*), cooked food and baked goods, garden produce, fuel, firewood, and bushmeat.

- The sale of fish and other seafood.⁴

Participants in the informal economy as a broad group often exhibit characteristics that indicate vulnerability in the Papua New Guinean context, such as women, single-parent families, illiterate persons or people with low levels of education (Kopel et al. 2021). Given the importance of the informal economy to household income, particularly vulnerable groups, the underlying sensitivity of opportunities for engagement in the informal economy has been rated as **very sensitive**.

Mechanism of change

The following Project activities may result in increased or decreased activity within the informal economy including:

- Increased availability of cash in the broader economy from direct, indirect, and induced Project employment.
- The upgrade of Lea Lea Road to accommodate the efficient transportation of service providers, materials and large modules required for the Project's construction.

Potential social impact

The Project's direct, indirect, and induced employment is likely to stimulate the cash economy within the LNG Plant communities (see above), which in turn is expected to result in increased demand for the range of activities that occur within the informal economy in the LNG Plant communities. For example, evidence from the development of other large-scale projects has noted that the spillover effect of increased availability of cash within a community often results in increased demand for transport services, small-scale markets and trade stores and other mainstays of the informal sector (Bainton and Macintyre 2013; Kuir-Ayius 2016).

This effect is expected to be at its greatest during the Project's construction period and is expected to increase the incomes of participants in the informal economy across the LNG Plant communities, along with supporting this sector to expand. Although it is not possible to quantify the level of increased income or the expansion of the informal economy due to the Project's activities, the increase is expected to be noticeable. Overall, the magnitude of increased demand for goods and services in the informal economy is expected to be low, resulting in a potential impact with a **moderate significance**, as shown in Table 13.21. The Project's impact on opportunities to participate in the informal economy in this regard is indirect and positive and not assessed further.

The upgrading of Lea Lea Road may require the temporary relocation of market stalls that are present within the road reserve. These stalls sell a range of small goods, including betelnut, cigarettes, fuel, rice, and cooked goods. The relocation process may require the relocation of stallholders to either a section of road that is not being upgraded, or relocation to an area of road that has already been upgraded. This process will likely take place over a very short amount of time (e.g., a few hours). During relocation, stallholders will likely not be able to carry on their usual business activities, which may result in a reduction in business income, although the reduction is expected to be minor. Conversely, the presence of an active construction workforce to upgrade the road and for the construction of the Project overall is likely to increase the client-base along Lea Lea Road and could therefore create opportunities for increased income. Overall, the magnitude of decreased incomes for stallholders due to relocation is expected to be very low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

Mitigation and management measures

The measures proposed to mitigate and manage the Project's potential impacts on opportunities to participate in the informal economy and the management plan that these measures will be incorporated are summarised in Table 13.9.

⁴ Potential impacts to the ability of LNG Plant communities to harvest natural resources, including marine resources, are discussed in Section 13.1.4.1.

Table 13.9 Availability of opportunities for engagement in the informal economy

Potential impact	Mitigation and management measures
Reduced opportunity to engage in informal economy activities.	The Community Development Support Plan includes measures to support the livelihoods within LNG Plant communities from the impacts of the Project. These measures include: • Undertake pre-construction surveys to identify the number of market stalls, their condition and the need to relocate stalls prior to undertaking road upgrade activities. • EMPNGA will engage with potentially affected persons regarding road upgrade activities and possible relocation requirements for stallholders. • Affected persons will be aided with transporting their belongings to the identified relocation sites. EMPNGA will provide additional assistance to vulnerable people such as the aged, people with disabilities, and single female households.

Residual impact assessment

It is expected that measures in the Community Development Support Plan will identify and support stallholders to limit potential impacts that relocation may have on their livelihoods, noting that relocation activities will likely be undertaken in a very short timeframe. On this basis, it is expected that the potential for impacts to stallholders livelihoods will likely be limited. Consequently, the Project's potential impact on engagement in the informal economy is rated as follows and summarised in Table 13.21.

- The magnitude of decreased incomes for stallholders due to relocation is expected to remain **very low**, resulting in a potential impact with a **low significance**. It is noted that there may not be any requirement for relocation of stallholders, depending on the location of works and the location of stallholders.

Engagement in enterprise-based activities

There are limited formal business activities within LNG Plant communities, with the primary businesses developed within these communities being Laba Holdings. Laba Holdings is the umbrella Representative Landowner Company that was established for the PNG LNG Project to represent the interests of the LNG Plant communities. Laba Holdings represents the landowner companies established for each LNG Plant community, including Porebada Holdings Limited, Boera Holdings Limited, Papa Resources Development Limited and BuriaRearea Caution Bay Limited (EMPNG 2022a).

Laba Holdings currently provides catering, camp administration, security services, vegetation control, and transport and logistics for PNG LNG. The catering, camp administration and security services are provided in a joint venture arrangement with National Catering Service, a landowner company from Lihir. The current workforce under Laba Holdings is around 243 workers, of which 20% are female.

Landowner companies provide a significant vehicle for local enterprise development, which in turn supports local employment and economic development within LNG Plant communities; consequently, the underlying sensitivity of opportunities for engagement in enterprise-based activities has been rated as **very sensitive**.

Mechanism of change

The Project's construction will involve a range of goods and services that will be delivered through contractors, as detailed in Section 13.1.3. In addition, a portion of the Project's workforce will be employed through third-party contractors.

The Project's operation will continue to require a range of goods and services that will be delivered through contractors; however, the level of demand will be significantly reduced from that required during construction.

Potential social impact

The Project's construction will generate further opportunities for contracting by Laba Holdings, other landowner companies, and other businesses within the LNG Plant communities. These opportunities will include contracting opportunities in services that Laba Holdings currently provides to the PNG LNG Project. In addition, it is expected that landowner companies will be the vehicle through which much of the Project's basic skilled construction local workforce is employed. It is expected that the demand will be considerable; by way of example, during the construction of the PNG LNG Project, Laba Holdings employed almost 2,500 persons from the LNG Plant villages (EMPNG 2022a). Overall, the magnitude of the potential increased demand for enterprise-based services from LNG Plant communities during construction is expected to be low, resulting in a potential impact with a **moderate significance**, as shown in Table 13.21.

The Project's operation will continue to require goods and services and therefore will continue to provide opportunities for contracting for landowner companies. However, as noted above, the level of demand will be significantly reduced from that required during construction. There is likely to be ongoing opportunities for landowner companies throughout the Project's operational life, as is evidenced by the ongoing engagement of Laba Holdings with the PNG LNG Project. Overall, the magnitude of the potential increased demand for enterprise-based services from LNG Plant communities during operation are expected to be low, resulting in a potential impact with a **moderate significance**, as shown in Table 13.21.

ExxonMobil is committed to the ongoing development of Papua New Guinean suppliers, in line with the EMPNGA is committed to the ongoing development of Papua New Guinean suppliers, in line with the requirements of the *Oil and Gas Act 1998*. Pursuant to global best practices, the PNG LNG Project established the Enterprise Centre as detailed in Section 13.1.3.1. During consultation undertaken in 2022, the Enterprise Centre reported that they are currently assisting Laba Holdings to attain ISO 9001 accreditation. The Project will work with the Enterprise Centre to support the ongoing capacity building of enterprises within LNG Plant communities. Overall, the magnitude of the potential increases in the capacity of enterprises within LNG Plant communities is expected to low, resulting in a potential impact with a **moderate significance**, as shown in Table 13.21.

Mitigation and management measures

The measures proposed to manage and enhance the Project's potential impacts on opportunities to participate in the cash economy and the management plan that these measures will be incorporated are summarised in Table 13.10.

Table 13.10 Availability of opportunities for engagement in enterprise-based activities

Impact	Mitigation and management measures
Improved opportunities for enterprise-based activities.	The National Content Plan includes measures to promote the participation of Papua New Guinean suppliers during the Project's construction and operation. These measures include: • A commitment to use and purchase Papua New Guinean goods and services wherever they are comparable to foreign-sourced suppliers in terms of cost, availability, quality, and are specification compliant. • Contractors will be required to develop National Content Plans that will identify what goods and services are required for the work package, where Papua New

Impact	Mitigation and management measures
	Guinean-owned companies could participate, and how the contactor will increase the participation of these companies. • Work with the Enterprise Centre to support the Project through: ○ Undertaking a non-technical assessment of Papua New Guinean business capacity gaps considering the Project's anticipated needs to inform the development and delivery of business training courses. ○ Supplier outreach and registration, including the launch of a supplier management portal platform. The supplier management portal will allow for Papua New Guinean businesses to register, and pre-verify their credentials, and receive procurement notices, and other Project communications. ○ Contractors will be required to utilise the Centre's supplier management portal for the dissemination of contracting opportunities. • ExxonMobil will engage with operational contractors to identify potential scopes that can be pursued with landowner companies. ExxonMobil will continue to support the development of landowner company capacity and capability. • ExxonMobil will engage with relevant industry stakeholders directly and through the Enterprise Centre to provide information about the status of the Project and National Content progress. • ExxonMobil will encourage the Enterprise Centre to identify through its member banks ways to improve access to finance for Papua New Guinean suppliers, including through industry engagement and education.

Residual impact assessment

The measures in the National Content Plan are expected to expand on the learnings from the PNG LNG Project, and maximise the identification, participation, and development of landowner companies. Consequently, following the implementation of mitigation and management measures, the Project's potential impacts on LNG plant communities to participate in enterprise-based activities are rated as follows and summarised in Table 13.21:

- The magnitude of the potential increased demand for enterprise-based services during construction is expected to increase from **low to moderate**, resulting in a potential impact with a **high significance**.
- The magnitude of the potential increased demand for enterprise-based services during operation is expected to increase from **low to moderate**, resulting in a potential impact with a **high significance**.
- The magnitude of the potential increases in the capacity of enterprises within the LNG Plant communities is expected to increase from **low to moderate**, resulting in a potential impact with a **high significance**.

All potential impacts on opportunities to engage in enterprise-based activities are positive impacts.

Papua LNG Project royalty and equity benefit streams

The relevant social attribute for assessing the impact of these Papua LNG Project benefit streams is the availability of cash at the household level, the context for which is provided at the beginning of this section. Based on the value that LNG Plant communities place on the availability of opportunities to increase cash incomes and the indications that expenditure often exceeds income, the underlying sensitivity of opportunities to increase cash incomes has been rated as **very sensitive**.

Mechanism of change

As noted in Section 13.1.2, the Papua LNG Project's benefit streams include royalties and equity benefits, to be distributed by the State to landowners.

Potential social impact

These Papua LNG Project's benefit streams will increase the level of personal and household income for landowners within the LNG Plant study area. The potential for an increase in royalties and equity payments was raised as a Project benefit during the consultation undertaken for this social impact assessment and the social baseline study (see Appendix C Social Baseline). However, between 20% and 30% of respondents to the household survey in each community and participants in focus group discussions expressed the view that the impact of royalty and equity payments will be limited. This in part appears to be related to dissatisfaction with the delays in distributing the PNG LNG Project's royalty and equity by the Papua New Guinean government (see Filer, 2019). However, the royalty and equity arrangements for LNG Plant communities for the Project will differ from the PNG LNG Project with the allocation and payment to be agreed between the State of Papua New Guinea, Papua LNG Project landowners and local level and provincial governments.

Overall, the Papua LNG Project's royalty and equity benefit streams will likely result in a minor increase in household incomes for landowners. The increase will occur across the Papua LNG Project's life, following the completion of construction. The magnitude of increased household incomes for landowners from royalty and equity payments is expected to be very low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

Mitigation and management measures and residual impact assessment

As the impact is positive and mandated by the laws of Papua New Guinea, no mitigation and management measures have been proposed. Consequently, there are no changes to the magnitude of the potential impact, and the residual significance of the Project's potential impact from the Project's benefit streams is **low**.

13.1.4.3 Social value 3: the ability to sustain cultural identity and traditions

This section considers how the Project's activities may affect the capacity of communities within the LNG Plant study area to sustain cultural identity and traditions. The attributes that contribute to this social value that may be affected by the Project, directly or indirectly, include the community's access and attachment to land, and the ongoing production and participation in traditional activities, including fishing.

Based on the findings of Appendix C Social Baseline, there is an ongoing cultural transition occurring in the LNG Plant communities as these communities become increasingly urbanised. Moreover, participants in focus group discussions undertaken for this impact assessment process asserted that cultural identity is strongly linked with access to land (including land for gardening) and knowledge and recognition of land ownership, including boundaries, is declining.

Communities within the study area villages indicated that traditional activities, such as fishing, canoe making and pottery production, still occurred but were declining (Appendix C Social Baseline). This decline was attributed to increasing reliance on and availability of wages and therefore reduced time and need to undertake traditional activities. Specifically in regards to fishing, the traditions associated with fishing, including some rituals, have decreased, and modern materials and methods have largely replaced traditional materials and methods; notwithstanding this, fishing and gleaning remain important to Motu cultural identity (Wu, 2020). Population growth and marriages between different cultures were also highlighted as factors contributing to a decline in traditional practice and cultural knowledge. The underlying sensitivity of the ability to sustain cultural identity and traditions has been rated as **sensitive**.

Mechanism of change

As detailed in Section 13.1.2, the Project's employment opportunities, business development opportunities, and benefits streams are expected to increase some household incomes in the LNG Plant villages, particularly during the Project's construction period. Following the reduction in the Project's required workforce at the end of construction, it is likely that these household incomes will likely decrease as opportunities for participating in the Project's employment and business development opportunities decrease. The Project's development is also likely to result in direct PIIM persons seeking employment during the construction phase, along with indirect in-migration associated with the development of the area.

Potential social impact

The Project's activities may contribute to the ongoing cultural transition occurring in the LNG Plant communities, including:

- A reduction in the production and in the transmission of knowledge of how to produce traditional handicrafts, including canoe making and pottery.
- Increased loss of access to land.

The Project's potential to result in a reduction in the knowledge and production of traditional handicrafts is expected to occur over the Project's operational life. The Project's employment (direct, indirect, and induced), business development opportunities and benefit streams are expected to reduce the need to participate in the production of handicraft activities, such as canoes and pottery to support livelihoods. Similarly, greater opportunities for participation in the cash economy may reduce people's time available to participate in traditional activities. As noted above, this is an existing process that is occurring within the LNG Plant communities and is occurring in part due to people's prioritisation of other livelihood activities.

Consequently, the Project's activities are expected to contribute to an ongoing decline in the importance of traditional activities. The level of impact will be proportional to the level of employment or other opportunities that are presented directly or indirectly by the Project, which as noted previously (Section 13.1.4.1), will likely be considerably lower during the Project's operation. The effect of short-term employment with the Project is considered immaterial to the knowledge and production of traditional activities and has not been assessed.

Overall, the magnitude of the potential decreases to the production of traditional handicrafts are expected to be low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

As noted previously, there are long-term social processes resulting in in-migration to these communities, of which the PNG LNG Project has contributed to indirectly, and the Project will likely continue to contribute to, including:

- Broader development of the area around the LNG Plant, of which the PNG LNG Project was a catalyst (see Appendix D Traffic and Land Use); the development of the area along with its proximity to Port Moresby was noted by participants in consultation to have made the LNG Plant communities more attractive to in-migrants.
- Employment at the integrated LNG Plant, although it is noted that the operational workforce is planned to increase by approximately 50 operations and maintenance technicians, Camp A's 500 beds will be sufficient to support the Project for Operations phase (Section 13.1.2.1).
- Amenity and services and perceived potential for improvement of these are associated with the presence of the LNG Plant.
- Natural population growth.

As articulated above, access to and attachment to land is a core component of cultural identity in the LNG Plant communities and in many Papua New Guinean communities (see Bainton and Banks 2018). The potential for changed access and attachment to land to occur due to the Project's activities is expected to

occur primarily over the long-term – that is, although in-migration during the Project's construction may constrain land access temporarily, this is not expected to result in challenges to sustaining cultural identity in the long-term, which is likely to be a by-product of permanent rather than temporary population growth. For example, during consultation with LNG Plant communities undertaken for this study, it was noted that more recent in-migration has resulted in conflict and concerns about ongoing land access.

Consequently, the Project's operation may contribute to ongoing in-migration and population growth, which has the potential to affect the ability of LNG Plant communities to access and sustain an attachment to land. Overall, the magnitude of this is expected to be medium, resulting in a potential impact with a **moderate significance**, as shown in Table 13.21.

Mitigation and management measures

The measures proposed to mitigate and manage the Project's potential impacts on cultural identity and traditions and the relevant management plan that these measures are incorporated within are summarised in Table 13.11.

Table 13.11 Cultural identity and traditions – management response

Potential impact	Mitigation and management measures
The Project's activities may contribute to a reduction in the production of traditional handicrafts.	The Community Development Support Plan includes measures to limit the Project's potential impacts on cultural domains that may be sensitive to Project activities, including: • Maintain an understanding of and respect for cultural norms (language, ethnic affiliation, religion, social organisations, gender roles, rituals, forms of cultural expression, traditional techniques and activities, local leadership patterns) of local communities through consultation (with affected communities, traditional leaders, clan representatives, site users and minority groups) and foreign staff training (in local history and cultural practices, including site specific training relating to particular communities within the Project area). • Identify and support key cultural knowledge and activities of LNG Plant village communities to reduce the Project's impacts on these.
The Project may affect the ability of LNG Plant communities to access and sustain an attachment to land due to in-migration.	The Project Induced In-migration Management Plan includes measures to limit in-migration. These measures include: • Minimising the incentive for in-migration through developing and communicating clear practices for recruitment, contracting, camp management and workforce accommodation, site access, and transport and logistics. • EMPNGA will work with key stakeholders and LNG Plant communities to identify community infrastructure and resources that may need additional support in each specific community due to the effects of PIIM. This may incorporate a range of actions as agreed with LNG Plant communities, including but not limited to the development of strategic plans to provide for adequate access to and maintenance of community services, infrastructure and resources, including but not limited to housing, water and sanitation, education and health care. • EMPNGA will work with key stakeholders and LNG Plant communities to: ○ Identify potential PIIM and work with key stakeholders (government and LNG Plant community leaders) and Project functions to create systems to deter PIIM. ○ Promote multi-stakeholders' involvement and management of potential PIIM impacts and opportunities. • Develop PIIM indicators for monitoring and reporting across the Project's construction and where appropriate operation.

Residual impact assessment

The measures in the Community Development Support Plan are designed to identify and limit the Project's potential impacts on cultural activities, and where appropriate support these activities; however, it is recognised that there is an existing cultural transition from the production of traditional handicrafts, including canoe making and pottery. Consequently, the overall contribution of Project activities to a reduction in the production and transmission of knowledge of traditional handicraft production is likely to be limited. The Project's potential PIIM will be limited in the first instance through employment measures in the Project Induced In-migration Management Plan, which will reduce the Project's contribution to existing in-migration processes that are affecting the ability of LNG Plant communities to sustain cultural attachments to land. Consequently, the Project's potential impacts on cultural identity and traditions are rated as follows and summarised in Table 13.21.

- The magnitude of the potential reduction in the production of traditional handicrafts is expected to reduce from **low to very low**, resulting in a potential impact with a **low significance**.
- The magnitude of detrimental changes to the ability of LNG Plant communities to access and sustain an attachment to land is expected to reduce from **moderate to low**, resulting in a potential impact with a **low significance**.

13.1.4.4 Social value 4: an environment supportive of personal, family and community health, safety, security and social wellbeing

This section considers how the Project's activities may impact on qualities in the social environment that are supportive of personal and family health, community safety and security. The attributes that contribute to this social value that may be affected by the Project, directly or indirectly, include food security, community safety, transactional sex, partnering and parenting, community amenity and the quality of the air and noise environment, and community health.

Food security and nutrition

Food insecurity is an ongoing issue across Papua New Guinea, including Port Moresby and surrounding areas (Bourke, 2020; Pandey and Howes, 2021). As detailed in Appendix C Social Baseline, food shortages were reported in many households during the household survey period. This was a particular issue in Porebada, where 23% of households reported a food shortage. The underlying sensitivity of household food security and nutrition has been rated as **very sensitive**.

Mechanism of change

As detailed in Section 13.1.4.2, the Project's employment opportunities, business development opportunities, and benefit streams are expected to increase some household incomes in the LNG Plant villages, particularly during the Project's construction period. Following the reduction in the Project's required workforce at the end of construction, it is likely that these household incomes will likely decrease as opportunities for participating in the Project's employment and business development opportunities decrease.

More broadly, communities reported concerns that the LNG Plant flaring system has resulted in adverse impacts on rainwater and subsequently garden crops, and fish health due to the perceived effects on marine waters was also raised a community concern.

Potential social impact

Increasing household incomes may improve household access to food. Research has found that household spending on food increases along with household income in PNG (Allen, Bourke and Hanson, 2000; Hurney, 2017). This relationship was indicated in the household survey of LNG Plant villages, where a shortage of money was commonly cited as one of the reasons for food shortages. This effect will be most noticeable in households that gain employment, or otherwise participate in landowner business opportunities. A more

subdued effect is expected in households that can participate in opportunities in the informal sector, along with households that will receive royalty and equity dividends.

Overall, the Project's potential to contribute to changes in household food access is expected to be at its greatest during the Project's construction. The magnitude of potential changes in household food security are expected to be low, resulting in a potential with a **moderate significance**, as shown in Table 13.21. As noted previously, beneficial impacts will be differentiated between households, with some households achieving greater increases in income and therefore flow on impacts (i.e., improved food security).

However, there is also the potential that the general increase in economic activity in LNG Plant communities (see Section 13.1.4.2) will inflate the cost of goods, including food, in LNG Plant communities. Inflation and increased costs of goods and services has been documented as a common negative social impact experienced in resource communities in Australia as well as developing countries, such as Lihir Island in Papua New Guinea (Kemp et al., 2012; Mancini and Sala, 2018). This effect will be more pronounced in households that are unable to participate in the Project's opportunities and therefore will not have increased household incomes to respond to inflationary pressure and will have to travel further to purchase goods at lower rates. This potential impact is expected to primarily be associated with the construction phase of the Project. The magnitude of potential detrimental changes in food access are expected to be low, resulting in a potential with a **moderate significance**, as shown in Table 13.21.

An increase in household income from employment may contribute to an increase in the consumption of processed foods. Specifically, increases in household incomes are understood to increase consumption of high-calorie, low-nutrition foods, which may result in poor health outcomes (e.g., obesity, metabolic syndrome, hypertension and diabetes) (Pus et al. 2016; Schmidt and Fang 2021). Based on longitudinal data collected for the PNG LNG Project in the LNG Plant communities between 2012 and 2016, there was a 'marked rise in surveilled communities in non-communicable diseases, including obesity, diabetes, hypertension, and elevated lipids' (Kumar and Krieger 2018).

Increased consumption of nutritionally poor food and the potential for subsequent impacts to health is likely to primarily occur during the Project's construction and occur in a subset of households that are able to achieve a material change in household income. The magnitude of potential detrimental changes in household health outcomes is expected to be medium, resulting in a potential impact with a **high significance**, as shown in Table 13.21.

As noted above, it is expected that some household incomes will likely reduce in line with the reduction in Project-based employment (direct and indirect through business opportunities / increased opportunities in the informal economy) following the end of the construction. During consultation undertaken for this EIS, participants reported that food shortages were experienced following the completion of the PNG LNG's construction period, which were attributed by participants to not planting or maintaining gardens during their employment. Food shortages related to this are likely to be temporary; however, an increase in food shortages will likely expose households to notable if temporary challenges. The extent of the potential impact will likely be limited to those households that were able to gain access to employment opportunities. Consequently, the magnitude of potential changes detrimental changes in household food security is expected to be medium, resulting in a potential impact with a **high significance**, as shown in Table 13.21.

Some participants in consultation undertaken for this study in 2019 and in follow up consultation in 2023 reported concerns that the LNG Plant flare system is resulting in potential impacts on rainwater quality and impacting agricultural outputs of gardens in LNG Plant communities. Notwithstanding that soil quality and water scarcity are widespread gardening constraints (Appendix C Social Baseline), there is a persistent perception by some in the LNG Plant communities that the LNG Plant flare has resulted in potential adverse impacts on gardening outputs, and therefore is perceived to have affected food security for some households. The only plausible pathway for an effect on vegetation from the LNG Plant to occur is through sulphur dioxide emissions. The current LNG Plant emissions have been modelled to be negligible (Appendix J Air Quality Assessment). Similarly, modelling of the Project's potential sulphur dioxide emissions has been found to meet

the criteria established for the protection of vegetation. Consequently, there is no plausible pathway for the Project to affect food security in this manner and the potential impact has not been assessed.

Mitigation and management measures

The measures proposed to mitigate and manage the Project's potential impacts on food security and health outcomes and the relevant management plan that these measures are incorporated within are summarised in Table 13.12.

Table 13.12 Food security and health outcomes – management response

Potential impact	Mitigation and management measures
Detrimental changes in rates of non-communicable diseases due to increased consumption of processed foods.	The Community Health, Safety and Security Management Plan will include measures to manage the potential impacts related to non-communicable diseases due to increased consumption of processed foods. These measures include: ExxonMobil will investigate working with relevant organisations where available and appropriate to develop and implement information, education and communication programs and nutritional programs among Project workers to promote proper nutrition practices.
Decreased food security due to inflation.	The Community Development Support Plan includes measures to support the diversification of livelihoods within LNG Plant communities. These measures include: - Support of sustainable livelihood diversification programs in consultation with government and non-government stakeholders. The programs will be identified and developed through needs-based assessments and community consultation and will aim to diversify and increase production in the LNG Plant villages through best practice techniques. Needs-based assessments and community consultation will take into account production activities by men, women and youth, and access rights to areas of impact. The program may include: - Undertaking periodic monitoring of livelihoods within the LNG Plant communities across the Project's lifecycle to identify Project-related impacts community livelihood's and support the development of appropriate livelihood diversification programs.
Decreased food security following retrenchment	The Requirements for Workforce Relations and Working Conditions document will include measures to manage potential impacts associated with retrenchment at the conclusion of the Project. These measures include: - Contractors will develop a retrenchment management strategy for their workforce, which will: - Be compliant with national law and collective bargaining agreements. - Detail a staggered approach to demobilisation and the number of workers to be demobilised. - If the retrenchment is envisaged to be significant, analyse the potential adverse impacts on the community to assist with the retrenchment planning. - All retrenched workers will be provided with statements of service, records of employment history, skills acquired, and training completed during employment. - Develop and implement communication timetables to prepare workers and the broader community of Project phase transitions and implications for direct, indirect, and induced employment. This communication timetable will incorporate adequate timeframes to allow sufficient time for subsistence lifestyle responses (e.g., adequate time for common crops to be planted).

Residual impact assessment

The Project's potential impacts on household food security and nutrition will be managed through a range of measures that are designed to respond to the potential distribution of effects on household food security and nutrition during the Project's life. Specifically, the potential for household consumption of high calorie, nutritionally poor food will be managed through targeted workforce education programs, where appropriate. However, the Project's capacity to manage individual household choices is limited.

Should localised inflation occur, it is recognised that some households may be more adversely affected than others; however, support for livelihood diversification programs within the Community Development Support Program is expected to support the level of livelihood resilience in LNG Plant communities. It is possible that there are households that may be affected by short-term changes in access to food due to inflation. Measures within the Requirements for Workforce Relations and Working Conditions document are expected to reduce the incidence of food security issues following retrenchment, although this may still occur at a household level. Consequently, the Project's potential direct and indirect impacts on food security and nutrition are rated as follows and summarised in Table 13.21:

- The magnitude of the potential detrimental changes to rates of non-communicable diseases due to increased consumption of processed food is expected to reduce from **moderate to low**, resulting in a potential impact with **moderate significance**.
- The magnitude of the potential detrimental changes to food security due to inflation is expected to reduce from **low to very low**, resulting in a potential impact with **low significance**.
- The magnitude of detrimental changes to food security following the completion of the construction phase is expected to reduce from **moderate to low**, resulting in a potential impact with a **moderate significance**.

The potential for household food security to improve as a result of improved household incomes is a potential beneficial impact, for which no further management measures have been proposed. Therefore, this potential impact has not been assessed further.

Community safety

As detailed in Appendix C Social Baseline, the LNG Plant villages reported experiencing a reduced perception of safety during the development of the PNG LNG Project, which was attributed during consultation by community members to increased incidences of public disorder (e.g., public drunkenness and violence and crime) and family and sexual violence. Poor perception of safety, public disorder, and crime remain issues for LNG Plant communities, although there is insufficient data available to ascertain whether these issues occur at any greater incidence in these communities than for other peri-urban environments in Papua New Guinea. The underlying sensitivity of community safety and cohesion is rated as **very sensitive**.

Although there are challenges in enumerating the level of family and sexual violence in PNG generally and no data was collected within the LNG Plant study area to quantify this issue, the weight of evidence within PNG generally indicates that levels of family and sexual violence are 'exceptionally high', with women being the primary victims (Putt and Dinnen 2020). Although most family and sexual violence occurs within the home by men known to the victim, research has also indicated that women in public places, such as market stallholders and women using public transport, have been subject to relatively high levels of sexual harassment and violence (UN Women 2014). Therefore, the underlying sensitivity of women's experience of safety is rated as **extremely sensitive**.

Mechanism of change

As detailed in Section 13.1.4.2, the Project's employment opportunities, and business development opportunities are expected to increase some household incomes in the LNG Plant villages, particularly during the Project's construction period. Following the reduction in the Project's required workforce at the end of construction, it is likely that these household incomes will decrease as opportunities for participating in the Project's employment and business development opportunities decrease.

The Project's development is also likely to result in direct PIIM of persons seeking employment during the construction phase, along with indirect in-migration associated with the development of the area.

Combined, these two factors may result in potential impacts on community safety and cohesion.

Potential impact

An increase in cash incomes and in-migration are linked to potential impacts on community safety and cohesion, including:

- An increase in 'anti-social' behaviours and reduced perception of safety
- An increase in crime and public disorder
- An increase in family and sexual violence.

An increase in 'anti-social' behaviours such as gambling, alcohol and sex work is commonly associated with resource development in Papua New Guinea and is often related to an increase in cash incomes, particularly for men (MacIntyre 2007, 2007, 2008; Blazey and Perkiss 2016; Beer 2018). During focus group discussions undertaken for this EIS, participants reported that villages were safer before the PNG LNG Project, attributing this change to the presence of outsiders within the community, and increased alcohol consumption. Consequently, it was reported that community members self-restrict their movements in the evening. Although this was raised during men's and women's focus group discussions, women noted higher levels of concern about safety, particularly regarding the presence of outsiders. In addition to the already noted reduction of movement in the night-time, reduced perceptions of safety may also reduce women and children's movements during the day. For example, during consultation undertaken in 2008 for the PNG LNG Project (Goldman 2008) concerns about safety were reported as the driver behind most women selling trade goods from stalls near their home, rather than locations that may support higher levels of sales, such as along the main road.

Although no definitive data is available, there is an extensive literature that argues that sexual violence and aggression against women and girls is prevalent to the extent that it is noted to be common place (Lepani 2008; Kelly-Hanku et al. 2016; Garbe and Struck-Garbe 2018). This violence is noted to be strongly linked to alcohol and drug consumption (Kelly-Hanku et al. 2016).

These concerns are a pre-existing issue within these villages and throughout Papua New Guinean society. However, an increase in the availability of cash in the community and direct and indirect in-migration has the potential to reduce community perception of safety during construction, with the effect reducing to similar levels experienced at present during operation. The effect is expected to be experienced in all LNG Plant communities and will be experienced at a greater intensity by women. The magnitude of the potential for the Project to contribute to a reduced perception of safety is expected to be medium, resulting in a potential impact with a **high significance**.

Similarly, the increase in alcohol use often linked to increased cash incomes and in-migration is linked to increases in conflict and public disorder. This was reported during focus group discussions and during household surveys as an issue that occurred during construction of the PNG LNG Project. As noted above, conflict between settlers and landowners in the LNG Plant villages is a current issue. The Project's activities are likely to exacerbate the levels of public disorder during construction due to increased cash incomes and

PIIM. The magnitude of the Project's potential to contribute to increased violence within the LNG Plant communities is expected to be medium, resulting in a potential impact with a **high significance**.

Finally, increased alcohol consumption as a by-product of increased household incomes is linked to increased levels of family and sexual violence. This issue was raised during consultation undertaken for the EIS, and is evidenced in the literature on the Project (Appendix C Social Baseline) and more broadly in regard to resource projects in Papua New Guinea and internationally (MacIntyre 2007, 2007, 2008; Blazey and Perkiss 2016; Beer 2018). Notwithstanding that family and sexual violence is a noted issue in Papua New Guinea, the increase in income and corresponding alcohol use is likely to exacerbate family and sexual violence in LNG Plant communities. The magnitude of the Project's potential to contribute to increased family and sexual violence within the LNG Plant communities is expected to be medium, resulting in a potential impact with a **high significance**.

Mitigation and management measures

The measures proposed to mitigate and manage the Project's potential impacts on community safety and the relevant management plan that these measures will be incorporated are summarised in Table 13.13.

Table 13.13 Community safety – management response

Impact	Mitigation and management measures
A reduced perception of safety.	The Community Health, Safety and Security Management Plan will include measures to manage the potential impacts on community safety associated with the Project's activities in the LNG Plant communities. These measures include: • Support and, where appropriate, build the capacity of civil or third-party institutions in communities to support village justice systems, police, traditional leadership, and authority structures to respond to anti-social behaviours.
An increase in crime and public disorder.	• Work with relevant organisations where available and appropriate (e.g., donors, civil society and NGOs) to raise community awareness regarding alcohol and other drugs use and management. The Project Induced In-migration Management Plan includes measures to limit in-migration. These measures include: • Minimising the incentive for in-migration through developing and communicating clear practices for recruitment, contracting, camp management and workforce accommodation, site access, and transport and logistics. • ExxonMobil will work with key stakeholders and LNG Plant communities to identify community infrastructure and resources that may need additional support in each specific community due to the effects of PIIM. This may incorporate a range of actions as agreed with LNG Plant communities, including but not limited to the development of strategic plans that can be implemented by government, communities, and as appropriate by the Project to assist communities to address items such as adequate access to and maintenance of community services, infrastructure and resources, including but not limited to housing, water and sanitation, education and health care. • EMPNGA will work with key stakeholders and LNG Plant communities to: ○ Identify potential PIIM and work with key stakeholders (government and LNG Plant community leaders) and Project functions to create systems to deter PIIM. ○ Promote multi-stakeholders involvement and management of potential PIIM impacts and opportunities. • Develop PIIM indicators for monitoring and reporting across the Project's construction and where appropriate operation.

Impact	Mitigation and management measures
An increase in family and sexual violence.	The Community Health, Safety and Security Management Plan will include measures to manage a potential increase in family and sexual violence as described in the “Potential Impact” section above. These measures include: • EMPNGA will work with relevant organisations where available and appropriate (e.g., donors, civil society and NGOs) to deliver family and sexual violence awareness and support programs within LNG Plant communities. • EMPNGA will work with relevant organisations to enhance community awareness on important societal topics, such as family and sexual violence within LNG Plant communities. • ExxonMobil will support the operational workforce to access family and sexual violence support services. • The ExxonMobil Community Grievance Mechanism will maintain gender-responsive features, such as: ○ Ensuring gender diversity in grievance mechanism staff and providing staff with gender sensitivity training. ○ Involving local women’s groups as potential points of contact for anonymous reporting and ongoing support for complainants. ○ Providing for independent, gender-sensitive investigations where there are serious allegations of gender-based violence by Project personnel.

Residual impact assessment

The Project’s potential direct and indirect impacts on community safety will be managed through a range of measures that are designed to address the potential changes to community safety, including an increase in anti-social behaviours, an increase in crime and public disorder, and an increase in family and sexual violence. The Project’s capacity to manage individual personal behavioural choices is limited. As is noted above, many of these potential impacts are tied to an increase in alcohol consumption and PIIM, which may occur during the Project’s construction period. Although EMPNGA will work with an organisation to raise community awareness about alcohol and drug use and management, it is expected that an increase in alcohol use is likely to occur in certain parts of the community regardless. As noted previously, although measures in the Project Induced In-migration Management Plan will support the reduction of PIIM, there remains the potential for a certain level of PIIM to occur.

On this basis, it is expected that there will likely be a short-term reduction in the perception of safety, along with temporary increases in public disorder, and family and sexual violence, all of which are driven by an increase in cash incomes, particularly for men. Measures have been identified to respond to these issues should they occur, including, but not limited to, supporting LNG Plant communities to respond to community safety issues and working with an organisation to support victims of family and sexual violence. Consequently, the Project’s potential direct and indirect impacts on community safety and cohesion are rated as follows and summarised in Table 13.21:

- The magnitude of the reduced perception of safety is expected to reduce from **medium to low**, resulting in a potential impact with a **moderate significance**.
- The magnitude of an increase in crime and public disorder is expected to reduce from **medium to low**, in a potential impact with a **moderate significance**.
- The magnitude of an increase in family and sexual violence is expected to reduce from **medium to low**, in a potential impact with **moderate significance**.

Community marine safety

As detailed in Appendix C Social Baseline, fishing and the gleaning of other marine resources (e.g., gathering of shells, mudcrabs, sea cucumber) is an important activity across all the LNG Plant villages. Fishing occurs across Caution Bay and out to the barrier reefs and open ocean. Results from the Caution Bay fisheries resource use study (Coffey 2020) show that between 2012 and 2019, the most common fishing location (aggregated for all villages) has shifted from the beach to the barrier reef and open sea. Dinghies are the most used vessels by fishers from Boera, Porebada and Lea Lea, while canoes were the most used vessel by fishers from Papa. The underlying sensitivity of community marine safety has been rated as **very sensitive**.

Mechanism of change

As detailed in Section 13.1.2.5, expansion of LNG Plant marine facilities will allow an increase in ship traffic associated with the integrated LNG Plant, with approximately 190 LNG carriers (60 to 70 additional LNG carriers) and 24 condensate cargos (10 to 12 additional condensate cargos) per year.

Potential impact

An increase in ship traffic within Caution Bay may result in potential impacts on the safety of non-Project marine users. The additional LNG carriers and condensate cargos will travel in the designated CALM buoy shipping channel, which travels in parallel to the existing shipping channel (see Figure 13.1). Public vessel movements will be excluded from the shipping channel during Project vessel approach and departure activities to maintain the safety of operations and non-Project marine users. However, it is recognised that there is potential for community users to enter into this exclusion zone and where this occurs, a collision may occur. Although existing marine exclusion zones were reported as well known and understood in LNG Plant communities during consultation undertaken for this EIS.

The effect of this traffic increase on community marine safety will be temporary (i.e., only when a ship is approaching or disembarking from the CALM buoy) and will be limited to a small group of fishermen who travel in this area. Overall, the magnitude of the Project's potential impact on community marine safety is moderate, resulting in a potential impact with a **high significance**, as shown in Table 13.21. This impact ranking is primarily driven by potential significant consequences associated with a marine vessel collision.

Mitigation and management measures

The measures proposed to mitigate and manage the Project's potential impacts on community marine safety and the relevant management plan that these measures will be incorporated are summarised in Table 13.13.

Table 13.14 Community marine safety – management response

Impact	Mitigation and management measures
Reduced community marine safety	The Stakeholder Engagement Plan will include measures to manage a potential reduction in community marine traffic safety, including awareness around the marine exclusion zones. The Environment and Social Management Plan includes measures to respond to emergency events, including developing an emergency response system for the Project, which will include a detailed initiation and response structure that covers the Emergency Support Group, Incident Management Team, and specific incident response arrangements.

Residual impact assessment

The Project's potential impacts on community marine safety will be managed through a range of measures that are designed to manage marine safety. As noted above, the primary measure to control marine safety is the establishment of the marine exclusion zone. Consequently, the Project's potential impact on community marine safety is rated as follows and summarised in Table 13.21:

- The magnitude of reduced community marine safety is expected to reduce from **moderate to low**, resulting in a potential impact with a **moderate significance**.

Partnering behaviours, transactional sex, sexually transmissible infections, increased single mothers, and sexual exploitation

Papua New Guinea has among the highest prevalence of HIV, syphilis, and other STIs in the Asia-Pacific region (Vallely et al. 2016; Vallely et al. 2010). The 2013/14 'Healthy Pregnancy Study' conducted by PNG IMR provides the most detailed STI data for the LNG Plant villages. These data were obtained through antenatal clinics at both Porebada and Papa sub-health centres with the following key findings:

- Chlamydia: 23.8%
- Gonorrhoea: 25%
- Trichomonas: 32.7%
- Herpes simplex virus-2: 20.5%
- Syphilis: 0.5%
- Human papillomavirus types 16 and 18: 10%
- HIV: 1.6%.

The 2013/14 PNG IMR data indicates that there is a significant underlying burden of STIs across the LNG Plant villages that is not diagnosed at local health facilities. The underlying sensitivity of community wellbeing and sexually transmitted infections is rated as **very sensitive**.

As detailed in Appendix C Social Baseline, LNG Plant communities reported during consultation that the increase in cash incomes associated with the PNG LNG Project resulted in a perceived increase in adultery and unplanned pregnancies. Issues regarding ongoing care and support for children are managed traditionally and through the village court. Single mothers are broadly recognised as vulnerable in the Papua New Guinean and other social contexts. The underlying sensitivity of women's socioeconomic wellbeing and reliance on long-term partnering behaviours is rated as **very sensitive**.

Mechanism of change

As detailed in Section 13.1.4.2, the Project's employment opportunities, business development opportunities, and benefit streams are expected to increase some household incomes in the LNG Plant villages, particularly during the Project's construction period. Following the reduction in the Project's required workforce at the end of construction, it is likely that these household incomes will decrease as opportunities for participating in the Project's employment and business development opportunities decrease.

The Project's development is also likely to result in the induced in-migration of persons seeking employment during the construction phase of the Project as well as any associated development of the area. In addition, the Project's workforce is expected to require the development of a large camp for the temporary construction workforce, which will likely result in a temporary and large increase in the male population in the area.

Potential impact

Evidence from other large-scale resource projects and from a social mapping project within Porebada in 2011 and 2012 (Tingim Laip 2013) indicates that an increase in personal income for men and an increased male population (both from PIIM and from the workforce) will likely increase the level of transactional sex in the LNG Plant villages, including resident men and women as well as migrant sex workers. This may occur in a range of forms, from an increase in purchasing sex⁵ to short-term relationships. Regardless of the form the

⁵ Although sex work is illegal in PNG, there is an established informal sex working industry in Port Moresby and throughout the country.

transactional sex takes, this may increase HIV and other sexually transmissible infections within the community (Zimmer-Tamakoshi 2012; Shih et al. 2017). Given the underlying burden of STIs in the community, an increase in transactional sex has the potential to increase community transmission of STIs, particularly during the construction period. The consequences of untreated sexually transmitted infections, particularly for women, can be significant (e.g., infertility, ectopic pregnancies, cervical cancer). This is complicated further by the lack of adequate facilities to diagnose and treat sexually transmitted infections (see Appendix C Social Baseline). Overall, the magnitude of the potential changes in rates of sexually transmitted infections within LNG Plant villages is expected to be moderate, resulting in an impact with a **high significance**, as shown in Table 13.21.

While short-term relationships may be mutually agreeable, these relationships present a greater risk of single parenthood for women, resulting in long-term socioeconomic deprivation for the single parent and children (Pham *et al.* 2021). The findings of a social engagement program focused on STIs, HIV, and sexual relationships during the PNG LNG Project (Tingim Laip 2013) found that some young women engaged in these transactional relationships were driven by a desire for money or other gifts from men which is a pattern seen in other projects where there is a noted increase in access to cash employment that is primarily accessible to men and not as accessible to women (World Bank 2019). This indicates that this issue is a product of underlying inequality for women in Papua New Guinea and the LNG Plant villages, which result in these women being less likely to be able to actively participate in employment and other opportunities.

Evidence from other large-scale resource projects and from a social mapping project within Porebada in 2011 and 2012 (Tingim Laip 2013) indicates that an increase in personal income for men and an increased male population (both from PIIM and from the workforce) will likely increase the level of transactional sex in the LNG Plant villages, which in turn will likely increase the number of single mothers across the LNG Plant villages. This potential impact will primarily occur during the Project's construction within the LNG Plant communities. Overall, the magnitude of the potential increase in single mothers within the LNG Plant communities is expected to be moderate, resulting in a potential impact with a **high significance**, as shown in Table 13.21.

Evidence from large-scale construction projects in Papua New Guinea and elsewhere has demonstrated that mobile workforces are associated with increases in transactional sex, resulting in similar impacts above. In addition, and at the most extreme, these workforces may also be associated with increased instances of child and sexual exploitation (World Bank 2019). The potential for this to occur is limited to the Project's construction phase and would be related to the level of interaction between the workforce and the LNG Plant communities, which overall is expected to be limited, based on the location of worker accommodation. The magnitude of a potential increase in the rate of sexual exploitation from the Project's external workforce is expected to be moderate, resulting in a potential impact with a **high significance**, as shown in Table 13.21.

Mitigation and management measures

The measures proposed to mitigate and manage the potential indirect on partnering behaviours, community wellbeing and sexually transmitted infections and the relevant management plans that these measures will be incorporated are summarised in Table 13.15.

Table 13.15 Sexual exploitation, partnering behaviours, community wellbeing and sexually transmitted infections – management response

Potential impact	Mitigation and management measures
Increase in sexual exploitation from the presence of an external workforce.	The Requirements for Camps and Accommodations document will include measures to limit the potential impact from increased cash incomes and an increased male population as a result of the Project. These measures include: The contractor shall enforce a closed camp policy for all workers (expatriates, other country nationals and national workforce on rotational work schedules). Workers shall be strictly controlled from leaving camps for non-work-related

Potential impact	Mitigation and management measures
	activities and prohibited from interacting with local communities unless agreed by the Community and EMPNGA. • Providing access to free condoms (including female condoms) at all work camps sites and accommodation. • Prohibiting consensual or non-consensual visitation by members of the opposite sex in designated living quarters. • Limiting workers interactions with the community when outside the camp. • All camp residents (expatriates, other country nationals and national workforce) will attend a camp induction program, including but not limited to: ○ Camp rules and regulations governing the closed camp policy, accommodation, and the behavior between fellow workers and the community. ○ Code of conduct. • Record, document and respond to grievances expressed by community members or local businesses in relation to camp-related activities / operations, in accordance with the Community Grievance Mechanism. • Cultural awareness to sensitise workers to issues of diversity in the workplace and local communities. The Community Health, Safety and Security Management Plan will include measures to limit any increase in transactional sex, and sexual violence. These measures include: • ExxonMobil will develop an effective interface with LNG Plant communities, village leaders and district authorities to report any increases in high-risk sexual behaviour from workers and any development of commercial sex work in communities linked to the Project workforce. • ExxonMobil will work with relevant organisations where available and appropriate to support. • ExxonMobil will continue to support the operational workforce to access family and sexual violence support services. • The ExxonMobil Community Grievance Mechanism will maintain gender-responsive features, such as: ○ Ensuring gender diversity in grievance mechanism staff and providing staff with gender sensitivity training. ○ Involving local women's groups as potential points of contact for anonymous reporting and ongoing support for complainants Providing for independent, gender-sensitive investigations where there are serious allegations of gender-based violence by company or contractor personnel. The Requirements for Workforce Relations and Working Conditions document will include measures to limit any increase in transactional sex between the external workforce and LNG Plant communities. These measures include: • ExxonMobil and contractors will develop and implement policies and procedures to prevent and manage worker behaviour. At a minimum, this will include a Code of Conduct setting out the behaviour expected from Project personnel on topics including, but not limited to: ○ Sexual exploitation ○ Child abuse and exploitation ○ Family and sexual violence ○ Discriminatory practices

Potential impact	Mitigation and management measures
	○ Drug and alcohol use ○ Sexual harassment within the workforce. • Contractors will develop a disciplinary procedure that will identify the process that will be followed if workers do not adhere to any code or rules and regulations. Contractors will be required to submit the final Code of Conduct for EMPNGA endorsement prior to construction works commencing. EMPNGA will monitor breaches of the Code of Conduct within its own workforce and contractors will be required to submit monthly reporting on breaches. • The contractor workforce will undergo induction training, and refresher training when required, that covers: ○ Workforce grievance procedure ○ Code of Conduct ○ Conditions of employment ○ Cultural awareness to sensitise workers to issues of diversity in the workplace and local communities. • Contractors will undertake an assessment to identify any potential risks posed to women, specific to Contractor's scopes of work, and provide ExxonMobil with a plan on how these risks will be mitigated, for its review and approval. ExxonMobil and contractors will develop a workers' grievance procedure, which will incorporate: ○ Anonymous reporting ○ Ongoing support for complainants ○ Training requirements for staff involved in the management and investigation of grievances, which will include gender sensitivity training ○ A procedure for responding to serious allegations of sexual harassment. The Community Health, Safety and Security Management Plan will include measures to limit any increase in transactional sex, and sexual violence. These measures include: • ExxonMobil will develop an effective interface with LNG Plant communities, village leaders and district authorities to report any increases in high-risk sexual behaviour from workers and any development of commercial sex work in communities linked to the Project workforce. • ExxonMobil will work with relevant organisations where available and appropriate to support. • ExxonMobil will continue to support the operational workforce to access family and sexual violence support services. • The ExxonMobil Community Grievance Mechanism will maintain gender-responsive features, such as: ○ Ensuring gender diversity in grievance mechanism staff and providing staff with gender sensitivity training. ○ Involving local women's groups as potential points of contact for anonymous reporting and ongoing support for complainants ○ Providing for independent, gender-sensitive investigations where there are serious allegations of gender-based violence by company or contractor personnel.
Increase in sexually transmissible infections within the community.	The Community Health, Safety and Security Management Plan will include measures to limit the potential impact from increased cash incomes and an increased male population as a result of the Project. These measures include:

Potential impact	Mitigation and management measures
	• EMPNGA will develop and implement a Project Communicable Disease Strategy prior to construction. The program will include but not be limited to: ○ Educating workers on the identification and treatment of curable sexually transmitted diseases, including providing condoms and femidoms to workers. ○ Maintaining voluntary counselling, testing and referral for testing for HIV consistent with local laws. ○ Work with relevant organisations where available and appropriate (e.g., donors, civil society and NGOs) to deliver a community health education campaign, which will include but not be limited to sexually transmitted infection prevention, identification, and management. The Requirements for Camps and Accommodations document will include measures to limit the potential impact from increased cash incomes and an increased male population as a result of the Project. These measures include: • The contractor shall enforce a closed camp policy for all workers (expatriates, other country nationals and national workforce on rotational work schedules). Workers shall be strictly controlled from leaving camps for non-work-related activities and prohibited from interacting with local communities unless agreed by the Community and EMPNGA. • Providing access to free condoms (including female condoms) at all work camps sites and accommodation. • Prohibiting consensual or non-consensual visitation by members of the opposite sex in designated living quarters. • Limiting workers interactions with the community when outside the camp. • All camp residents (expatriates, other country nationals and national workforce) will attend a camp induction program, including but not limited to: ○ Camp rules and regulations governing the closed camp policy, accommodation, and the behavior between fellow workers and the community. ○ Code of conduct. • Record, document and respond to grievances expressed by community members or local businesses in relation to camp-related activities / operation in accordance with the Community Grievance Mechanism. • Cultural awareness to sensitise workers to issues of diversity in the workplace and local communities.
Increased single mothers due to an increase in transactional sex.	As noted above, the Community Health, Safety and Security Management Plan will include measures to limit any increase in transactional sex, and sexual violence. These measures include: • EMPNGA will develop an effective interface with LNG Plant communities, village leaders and district authorities to report any increases in high-risk sexual behaviour from workers and any development of commercial sex work in communities linked to the Project workforce. • EMPNGA will work with relevant organisations where available and appropriate to support. • The EMPNGA Community Grievance Mechanism will maintain gender-responsive features, such as: ○ Ensuring gender diversity in grievance mechanism staff and providing staff with gender sensitivity training. ○ Involving local women's groups as potential points of contact for anonymous reporting and ongoing support for complainants

Potential impact	Mitigation and management measures
	○ Providing for independent, gender-sensitive investigations where there are serious allegations of gender-based violence by company or contractor personnel. The Requirements for Workforce Relations and Working Conditions document will include measures to limit any increase in transactional sex between the external workforce and LNG Plant communities. These measures include: • EMPNGA and contractors will develop and implement policies and procedures to prevent and manage worker behaviour. At a minimum, this will include a Code of Conduct setting out the behaviour expected from Project personnel on topics including, but not limited to: ○ Sexual exploitation ○ Child abuse and exploitation ○ Family and sexual violence discriminatory practices ○ Drug and alcohol use ○ Sexual harassment within the workforce. • Contractors will develop a disciplinary procedure that will identify the process that will be followed if workers do not adhere to any code or rules and regulations. Contractors will be required to submit the final Code of Conduct for EMPNGA endorsement prior to works commencing. EMPNGA will monitor breaches of the Code of Conduct within its own workforce and contractors will be required to submit monthly reporting on breaches. • The contractor workforce will undergo induction training, and refresher training when required, that covers: ○ Workforce grievance procedure ○ Code of Conduct ○ Conditions of employment ○ Cultural awareness to sensitise workers to issues of diversity in the workplace and local communities. • Contractors will undertake an assessment to identify any potential risks posed to women, specific to Contractor's scopes of work, and provide ExxonMobil with a plan on how these risks will be mitigated, for its review and approval. ExxonMobil and contractors will develop a workers' grievance procedure, which will incorporate: ○ Anonymous reporting ○ Ongoing support for complainants ○ Training requirements for staff involved in the management and investigation of grievances, which will include gender sensitivity training ○ A procedure for responding to serious allegations of sexual harassment.

Residual impact assessment

Changes within communities due to an increase in cash incomes and in-migration can result in potential impacts on partnering practices within LNG Plant communities and associated impacts, including a potential increase in sexually transmitted infections and an increase in single motherhood. These aspects will be managed through a range of measures that are designed to increase community understanding of sexually transmissible infections and family planning, and manage the potential risks from an external workforce interacting with the LNG Plant community. The Project's capacity to manage individual personal behavioural choices is limited. Although these measures are expected to reduce the overall incidence of any potential increase in sexually transmitted infections and an increase in single motherhood, it is recognised that these

are pre-existing community issues and common responses to resource projects; consequently, there may be a temporary and minor increase in these issues.

Separately, in regard to the potential for sexual exploitation to occur from interactions between the external Project workforce and the LNG Plant communities, it is expected that the measures identified will largely prevent interactions through the establishment of closed camps.

Consequently, the potential indirect impacts on partnering behaviours and associated impacts are rated as follows and summarised in Table 13.21:

- The magnitude of the potential increase in sexually transmissible infections is expected to reduce from **medium to low**, resulting in a potential impact with a **moderate significance**.
- The magnitude of an increase single mothers is expected to reduce from **medium to low**, resulting in a potential impact with a **moderate significance**.
- The magnitude of a potential increase in sexual exploitation from an external workforce is expected to reduce from **medium to low**, resulting in a potential impact with a **moderate significance**.

Community cohesion and governance

Incorporated land groups have been established under the *Land Groups Incorporation Act 1974* and support the distribution of royalties and equity payments, while landowner companies provide business and employment opportunities and the chance for landowners to share in the profits they generate from these activities. Overall, the results of the household survey undertaken in 2019 and the consultation undertaken in 2022 and 2023 indicate that there is a level of community tension regarding the governance of the landowner companies and the distribution of benefits, with frequent references made to unequal distribution of benefits and employment opportunities, attributed by many to the *wantok* system. The underlying sensitivity of community cohesion and governance in the LNG Plant villages has been rated as **very sensitive**.

Mechanism of change

As detailed in Section 13.1.4.2, the Project's employment opportunities, business development opportunities, and benefits streams are expected to increase some household incomes in the LNG Plant villages, particularly during the Project's construction period. Following the reduction in the Project's required workforce at the end of construction, it is likely that these household incomes will decrease as opportunities for participating in the Project's employment and business development opportunities decrease.

Potential impact

Experience from other resource projects in PNG and the PNG LNG Project has found that benefits such as employment and business contracts are accessed unequally within communities, which can result in community tension, conflict and an overall reduction in community cohesion (Bainton and Banks 2018). As noted above, communities reported that access to employment and business contracts during the construction of the PNG LNG Project were heavily influenced by the *wantok* system, resulting in the distribution of these benefits between family and clan members. Consultation indicated that there remains a degree of resentment within the LNG Plant communities regarding the effect of the *wantok* system on access to the PNG LNG Project's opportunities.

Based on the experience of the PNG LNG Project, the distribution of the Project's benefits may be unequal, leading to additional or a re-emergence of community tension, and reduce community cohesion. In a minority of cases, this may result in interpersonal conflict. This effect will be at its height during the construction phase but the potential impact of unequal benefit distribution on community cohesion will extend for some time thereafter. Overall, the magnitude of potential impacts on community cohesion and governance within the LNG Plant communities is expected to be moderate, resulting in a potential impact with a **high significance**, as shown in Table 13.21.

Mitigation and management measures

The measures proposed to mitigate and manage the potential indirect impacts on community cohesion and governance and the relevant management plans that these measures will be incorporated are summarised in Table 13.16.

Table 13.16 Community cohesion and governance – management response

Impact	Mitigation and management measures
Decreased community cohesion due to unequal distribution of Project's employment and business development opportunities	The National Content Plan includes measures to manage the potential for unequal and inequitable access to the Project's employment opportunities. These measures include: - ExxonMobil and its Contractors will monitor the distribution of employment across LNG Plant villages to identify any trends. Contractors will report on employment to ExxonMobil on a monthly basis. - ExxonMobil will engage with relevant LNG Plant community stakeholders to identify any emerging concerns regarding inequitable access to employment. - ExxonMobil and contractors will use objective and transparent selection criteria aligned to the requirements of the available jobs to select workers. Local workers not selected will be informed of the reason for this. - ExxonMobil and contractors will prepare a conflict-of-interest declaration for any recruitment or procurement decision, which includes a hierarchy of review of decisions. - ExxonMobil will monitor issues and grievances lodged through the Community Grievance Mechanism regarding access and equity to employment opportunities.

Residual impact assessment

The measures within the National Content Plan have been designed to address the potential for unequal and inequitable access to the Project's employment opportunities and a subsequent impact on community cohesion. Despite this, it is noted that there is a pre-existing community tension in this area, and that there will be community members that are not able to participate in the Project's benefits. On this basis, there remains potential for an increase of re-emergence of community tension and reduction in community cohesion, particularly during the construction phase. Consequently, the potential indirect impacts on community cohesion and governance are rated as follows and summarised in Table 13.21:

- The magnitude of the potential for decreased community cohesion is expected to reduce from **medium to low**, resulting in a potential impact with a **moderate significance**.

Personal security

Community concerns regarding delays in Project benefit streams have resulted in LNG Plant communities undertaking one protest outside of the LNG Plant as a result of delays in royalty distribution in 2017.

The Buria Police Post provides policing services to the nine Hiri west communities including the LNG Plant villages. In instances where large-scale law and order issues occur, the Royal PNG Constabulary (RPNGC) will be engaged. The use of excessive force and human rights abuses by the RPNGC in other parts of Papua New Guinea are well documented, and in particular mobile squads have an 'acquired notoriety for rough justice' (Dinnen 2020). The underlying sensitivity of personal security from police in the LNG Plant villages has been rated as **very sensitive**.

Mechanism of change

As detailed in Section 13.1.4.2, the Project is expected to result in several social opportunities, including employment opportunities, business development opportunities, and benefits streams. Similarly, the ongoing operation of the Project has several effects on the external environment, including restrictions in use and changes in amenity.

Potential impact

Project-related employment and business opportunities are almost uniformly seen as benefits; however, as demonstrated by the outcomes of consultation, they can also be sources of community tension. In addition, there is potential that community acceptance of the Project and its externalised impacts may become a source of community concern over the Project's life. At their height, community tension and conflict regarding the distribution of benefits or other concerns about the Project's environmental and social management may result in community protests. As noted above, large-scale protests may require a response from the RPNGC, during which community members may be subject to excessive force, impacting personal security. Similarly, should this occur, there is the potential for the Project's security personnel to use excessive force when engaging with community members. These events may occur throughout the Project's life, although there has been limited occurrence reported in the media or raised during community consultation of similar issues in these communities throughout the life of the PNG LNG Project. Consequently, the Project's potential to contribute to a reduction in personal security is expected to be moderate, resulting in a potential impact with a **high significance**, as shown in Table 13.21.

Mitigation and management measures

The measures proposed to mitigate and manage the Project's potential direct and indirect impacts on personal security and the relevant management plan that these measures will be incorporated are summarised in Table 13.17.

Table 13.17 Personal security – management response

Impact	Mitigation and management measures
Reduced personal security due to the use of excessive force by the RPNGC or the Project's security personnel.	The Community Health, Safety and Security Management Plan includes measures to manage community and personal security and the security of the workforce in line with the <i>Voluntary Principles on Security and Human Rights</i> (Voluntary Principles Initiative, 2015). These measures include: • Recognising that the Papua New Guinea government is ultimately responsible for maintaining law and order, providing security, and protecting and respecting human rights. • Ensuring ExxonMobil's interface with the Royal Papua New Guinea Constabulary (RPNGC) will be consistent with existing arrangements in a Memorandum of Understanding (MOU) between EMPNG and the RPNGC. The MOU plays an important role in establishing clear expectations as well as providing a solid foundation for the delivery of effective policing. According to the MOU, support can be offered for transport, fuel, lodging and stipends for the police away from their normal work locations. ExxonMobil will encourage the PNG Government to address security threats in areas adjoining Project operations without directly assigning public security forces to the Project or its personnel, facilities and operations. • For Project security personnel: ○ Ensure compliance of all Project security arrangements with the Project's Code of Conduct. ○ Contractors will ensure Project security personnel are unarmed. ○ Contractors will train, on induction and annually, Project security personnel on the Project's expectations and appropriate conduct towards workers and

Impact	Mitigation and management measures
	community members, including: exercising constraint and caution and understanding how force may be used; respecting human rights; gender sensitivity in the local cultural context and the Code of Conduct; behaving consistently; knowing and abiding by applicable laws; fostering good community relations through their interaction and behaviour towards the workforce and communities; not engaging in sexual exploitation or abuse, including any sexual activity with persons under the age of 18. ○ Contractors will screen Project security personnel prior to employment by means of detailed interviews in line with the 'International Code of Conduct for Private Security Service Providers' to avoid hiring those who have previously been involved in abuse or violation of human rights. ○ Contractors will provide appropriate supervision to ensure that established procedures are being applied by Project security personnel. ○ Contractors and ExxonMobil where appropriate will investigate credible allegations of unlawful behaviour or acts of abuse by Project security personnel and taking action (or urging the appropriate parties to take action). ○ Contractors and ExxonMobil where appropriate will take immediate action if unlawful or abusive acts are committed by Project security personnel. ○ Contractors and ExxonMobil where appropriate will report unlawful or abusive acts to public authorities.

Residual impact assessment

ExxonMobil has an existing process for managing the interface with the RPNGC in relation to security for the Project and has established procedures for complying with the *Voluntary Principles on Security and Human Rights*. The application of these processes is expected to reduce the potential for incidents of excessive force to occur from either the presence of RPNGGC or from company security personnel. Consequently, the Project's potential direct and indirect impacts on personal security are rated as follows and summarised in Table 13.21:

- The magnitude of the potential reduced personal security due to the use of excessive force by the RPNGC or the Project's security personnel is rated to be reduced from **medium to low**, resulting in a potential impact with **moderate significance**.

Community amenity and quality of the air and noise environment

The LNG Plant communities are peri-urban, predominantly coastal villages, surrounded by either savannah or denser vegetation where there are steeper slopes and watercourses or drainage areas. The coast is generally fringed by dense stands of mangroves.

Air emissions from the existing LNG Plant operations are the main source of air pollutants in the area. Two other notable sources of existing and future air emissions have been identified:

- NiuEnergy Power Station: A 50 MW gas-fired power station located approximately 4 km to the northeast of the LNG Plant site.
- Dirio Power Plant: A 47 MW gas-fired power station approximately 300 m east of the existing NiuEnergy Power Station.

Other potential sources of air emissions in the area include domestic and agricultural activities carried out in and around the villages of Lea Lea, Papa, Boera and Porebada, as well as traffic-related emissions from the roads that service them. These activities contribute minor emissions of particles, nitrogen dioxide, sulphur

dioxide and hydrocarbons. Natural sources of particulate matter, such as sea salt and smoke from local and remote fires, are also present.

PNG LNG commissioned an air quality monitoring program to monitor ambient air quality at the LNG Plant over a one-year period from July 2015 to July 2016. As there have been no changes in site operations since this monitoring was conducted that would have resulted in significant changes in the LNG plant site emissions, the measured on-site pollutant concentrations are expected to still be representative of current site conditions. The monitoring program found that:

- Particulate matter levels are normally low and below relevant criteria; short-term events of slightly elevated levels were recorded at times and were localised and attributed to loose gravel and dust generated by vehicles on Lea Lea Road near Gate 3.
- Ambient concentrations of nitrogen dioxide are well below the annual average guidelines.
- Ambient concentrations of sulfur dioxide are well below the annual average guidelines.
- Ambient concentrations of carbon monoxide are negligible.

The main sources of noise in the LNG Plant communities are natural sources, such as wind noise in foliage, animals, and insects, in addition to typical village noises (Appendix G Noise Impact Assessment). Operational noise from the LNG Plant, such as emergency flaring, occurs sporadically. Monitoring undertaken in 2019 in each of the LNG Plant villages recorded background noise levels of between 49 dBA and 55 dBA during the day (7.00 a.m. to 6.00 p.m.), remaining relatively constant in the evening (49 dBA and 52 dBA), and night (49 dBA and 57 dBA). Noise profiles in the evening and night remain relatively similar to the daytime due to the elevated insect noise after dark. These noise levels are in line with the ambient profiles recorded in other PNG village areas and that of a quiet suburban area in a developed country (NSW EPA 2013).

The existing air quality complies with relevant criteria (Appendix J Air Quality Assessment). The LNG Plant is the main source of air pollution in the area; other sources of air emissions include domestic and agricultural activities (e.g., fires), traffic-related emissions and natural sources (e.g., sea salt).

The existing LNG Plant occupies a substantial area and its presence and operations visible to both Papa and Lea Lea villages. Although the results from environmental monitoring indicate that the LNG Plant complies with relevant criteria, during the household surveys, approximately 60% of respondents in those villages reported a perceived high level of effect on environmental amenity primarily due to flaring effects. Common flaring effects reported by respondents included noise, light, odour and heat. A lower percentage of households in Porebada and Boera (approximately 40%) reported a high level of effect on environmental amenity. The level of perceived disruption to daily activities varied among stakeholders, indicating that different people are more sensitive to changes in amenity and character, with some households reporting adverse social impacts from noise and odour, such as disruptions to sleep, while others in the same village reported very limited impacts. The underlying sensitivity is rated as **sensitive**.

More broadly, communities reported concerns that the flaring system has resulted in impacts on health, with a perceived increase in respiratory issues reported by some.

Mechanism of change

The Project's construction activities will result in changes to the environment, which have the potential to affect amenity within LNG Plant villages. These changes are considered separately and include changes to:

- Air quality
- Noise
- Visual amenity.

These are discussed separately and then jointly to assess the potential social impacts of changes to amenity and character.

Air quality

The Project's construction activities will likely generate dust, which can include particulate matter (PM). The size of particles affects their potential to cause health problems. There are two different types of PM that may be associated with the Project's construction phase. These are:

- PM₁₀ can be found in dust. These particles are small enough to get into the throat and lungs and can enter the lungs and cause coughing, wheezing, asthma attacks, and more serious health issues, such as high blood pressure, heart attacks and strokes.
- PM_{2.5} are small enough that they can get deep into the lungs and may enter the bloodstream and cause wheezing, coughing, chest tightness and difficulty breathing.

The air quality assessment (Appendix J) found that while there is potential for short-term elevations in dust levels close to the construction areas, particularly during vegetation clearance and earthworks activities, no long-term air quality impacts are expected to occur during the construction phase. Revegetation of cleared areas will rapidly stabilise exposed soils and settled dust is likely to be cleaned off vegetation and other surfaces relatively quickly by rain.

With good practice air quality management, there is a low risk of adverse dust soiling and human health impacts at the nearest sensitive receptors during the construction phase of the project. Any potential impacts will be highly localised and are expected to be able to be managed through targeted dust suppression, supported by and consultation with potentially affected sensitive receptors. Further description of construction related air quality levels is provided in Section 11.5.

Modelling undertaken by the air quality assessment (Appendix J) for the Project's operation found that there will be no exceedances of modelled pollutants except for the following:

- For nitrogen dioxide (NO₂) emissions, predicted concentrations are expected to increase from the operation of the Project; however, the maximum 1-hour, 24-hour and annual average NO₂ concentrations at the sensitive receptors are predicted to remain well below the relevant criteria. No sensitive receptors are located in areas where concentrations are predicted to exceed criteria.
- For sulphur dioxide (SO₂), increases in 10-minute and 1-hour average concentrations are predicted at the sensitive receptor locations as a result of the Project due to combustion of organic sulphur compounds and hydrogen sulphide (H₂S) containing fuel gas. These concentrations, however, are below the relevant criteria for both existing and proposed operations, including normal and worst-case upset operating conditions.

Further description of operation related air quality emissions is provided in Section 11.5.

Noise

Noise modelling was undertaken for this EIS (Appendix G Noise Impact Assessment).

The predicted construction noise levels comply with noise criteria under 'neutral' and 'adverse' meteorological conditions during the day and night. Furthermore, construction noise is likely to be inaudible above the existing ambient background noise level (ranging from an average of 48 to 63 dB(A) at the most affected receptors), particularly during the night period. Further description of construction related noise levels is provided in Section 11.9.

The Project's operation activities will be fully integrated with the existing operations for the LNG Plant and marine facilities. The predicted noise levels show that proposed operational noise targets will be met at the perimeter boundary of the LNG Plant site. The noise levels will be well below noise targets at the nearest village receptors under all conditions, day and night. Evaluation of the cumulative noise level from all three noise generating operational aspects, i.e., the LNG Plant site, shipping and flare, shows that should all occur

simultaneously, the noise target will still be met. Further description of operation related noise levels is provided in Section 11.9.

Visual amenity

The Project's construction will generally be contained within the LNG Plant's current footprint. Construction activities within the LNG Plant's current footprint will be generally in line with the currently industrialised amenity of the LNG Plant.

Flare systems are provided in gas processing facilities to safely dispose of hydrocarbon fluids (gases and liquids) in the event that upsets, maintenance or safety concerns drive unforeseen releases. The new flare systems will be sized to accommodate the largest expected single event requiring gas release. For an LNG Plant, this is typically the discharge from a blocked refrigerant compressor. The flares will be designed to provide smokeless flaring over a maximum range of operation, and all flare headers will be continuously purged with low-pressure fuel gas.

As the Project's infrastructure will be largely retained within the existing LNG Plant footprint, it is expected that changes to visual amenity during operation will be limited. The CALM buoy is not expected to be visible from the communities and will result in a limited visual change in an already disturbed landscape. Consequently, changes to the landscape and visual amenity during operations are expected to be negligible. On this basis, changes to visual amenity during the Project's operation are not assessed further.

Potential impact

The findings of the air quality and noise assessment demonstrate that the air and noise emissions associated with the Project's construction activities are expected to be temporary and manageable.

Based on the current or baseline conditions, some people within the LNG Plant villages will be sensitive to the increases in noise, dust, and odour emissions that are associated with the Project. Community consultation indicates that noise and odour have generated the most perceived disturbance in the past, including reduced enjoyment of outdoor activities, along with sleep disturbance and general annoyance. These are primarily associated with the operation of the LNG Plant. As the Project's noise and odour emissions are likely to be similar, it is expected that these will be the same. However, as noted above, increases in these emissions may be experienced negatively by some people within the LNG Plant villages.

Overall, increased noise, dust and odour emissions may result in minor reductions in perceived amenity for some residents of LNG Plant villages, and in particular the five residences within 500 m of the LNG Plant. These changes are minor and are not predicted to have any adverse health effects. Consequently, the magnitude of potential changes in amenity and the effects of these on LNG Plant villages day to day lives are expected to be low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

In addition to works required at the LNG Plant and marine expansion activities, work on the Lea Lea Road will require minor works to upgrade or expand the road. The effects of emissions associated with these short-term activities have not been assessed specifically by modelling, but standard controls as applied in PNG and internationally will be applied to control dust and noise with particular care being applied to controls when works are taking place close to houses and places where dust and noise emissions could cause nuisance effects. In particular, there are a range of sensitive receptors located within a 500 m buffer either side of the road. These include residences, and other sensitive community uses, such as childcare centres, and schools. Decreased air quality and the noise environment during the day-time may have particular impacts on education and childcare facilities, such as those located in Edai Town; for example, activities such as learning or sleep-times for children may be sensitive to changes in the noise environment.

Works to rebuild the road will be temporary and construction activities will advance along the road corridor, limiting the period for which each sensitive receptor will experience the peak of amenity changes. Consequently, the magnitude of the Project's changes in amenity for sensitive receptors in proximity to works

on Lea Lea Road is expected to be low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

Impacts to the livelihoods of roadside stallholders due to changes in amenity are assessed in Section 13.1.4.1.

Mitigation and management measures

The Project's potential impacts on community amenity and the quality of the air and noise environment will be managed according to the Construction Noise Management Plan and the Construction Air Quality and Greenhouse Gas Emission Management Plan. The mitigation and management measures are detailed in Section 11.8.3 and Section 11.9.3 of Chapter 11: Environment Impact Assessment Onshore.

Residual impact assessment

The Project's potential impacts on community amenity are expected to be managed to the extent that changes in amenity will be temporary, and potential changes to people's day to day lives will be minor in nature. Consequently, the Project's potential impacts on community amenity and the quality of the air and noise environment are rated as follows and summarised in Table 13.21:

- The magnitude of the potential for decreased amenity due to the LNG Plant construction is expected to be reduced from **low to very low**, resulting in a potential impact with **low significance**.
- The magnitude of the potential for decreased amenity due to widening of Lea Lea Road is expected to be reduced from **low to very low**, resulting in a potential impact with **low significance**.

Community health

Improving community health is recognised as a government, community, and ExxonMobil priority. This section addresses the indicators of community health that may be affected by the Project's activities on an indicator-by-indicator basis and is structured differently to the remainder of this chapter. Specifically, the baseline status, mechanism of change, and potential impact assessment for each indicator are discussed individually rather than collectively, as has been done for other social values and their attributes. The community health indicators discussed in this section include:

- The incidence of mosquito-borne diseases
- The incidence of tuberculosis and respiratory diseases
- The incidence of sanitation-related diseases
- The incidence of traffic incidents.

The underlying sensitivity of community health is assessed collectively and is rated as **very sensitive**.

Mosquito-borne diseases

The Community Health Baseline (Appendix B) addresses vector-borne diseases including malaria and flaviviruses (e.g., dengue, Japanese Encephalitis, Zika, and Chikungunya) but notes that the only consistently diagnosed and reported data are for malaria.

Significant reductions in the prevalence of malaria – both nationally and within the LNG Plant villages – have been attributed to increased adoption and use of insecticide-treated bed nets and an increased proportion of confirmed cases treated with artemisinin-based combination therapy (Rosewell et al. 2017). In the LNG Plant villages, it is reported that such nets have been sourced from various sources, including RAM, Health Department, Global Fund, Papa Sub Health Centre, Porebada Sub Health Centre, and Boera Aid Post. Overall, while bed net ownership and use in the LNG Plant villages exceed Global Fund prescribed targets, it should also be noted that the reduction in the prevalence of malaria is also attributable to the availability of Rapid Diagnostic Tests (RDTs) that have resulted in cases of fever that have typically been reported as

malaria being attributed to other causes, most commonly respiratory illnesses. Finally, the Community Health Baseline (Appendix B) recognises that in-migration may be associated with the introduction of malaria ('visitor' malaria), the risk deemed higher for Lea-Lea, which serves as an existing entry point from the Gulf Province, an area that typically has a higher level of test positive malaria.

The Project's activities may result in an increase in the prevalence of mosquito-related diseases (e.g., lymphatic filariasis, malaria, dengue), through:

- The in-migration of people to the area. Specifically, the in-migration of people from areas where mosquito-borne diseases are more prevalent than in the LNG Plant villages could infect local mosquito populations, increasing the infection rate within LNG Plant communities (Martens and Hall 2000; Bichara 2018).
- The construction of the Project may expand breeding grounds for mosquitos and thereby increase the prevalence of mosquito-related diseases within the Project workforce and the LNG Plant communities (Liang et al., 2018; Wilke et al., 2019).
- The operation and occupation of closed camps housing a large workforce that originates from across Papua New Guinea and internationally could ostensibly result in the inadvertent introduction of malaria.

While changes in access to and operation of several village-level health services could adversely affect household bed net ownership and use, as well as the availability of RDTs, based on current practices, substantial outbreaks of malaria are expected to be unlikely. Overall, the magnitude of the potential increases in mosquito-borne diseases within the LNG Plant communities from the Project's activities is expected to be medium, resulting in a potential impact with a **high significance**, as shown in Table 13.21. This impact ranking is primarily driven by potential significant consequences associated with an outbreak of mosquito-borne diseases.

Tuberculosis and respiratory diseases

The Community Health Baseline (Appendix B) addressed communicable respiratory diseases. The transmission of communicable respiratory diseases (such as acute respiratory infections (ARIs), pneumonia, tuberculosis and meningitis) is strongly associated with:

- Inadequate house design, overcrowding (high household occupancy)
- Cooking/heating with wood as a primary fuel source
- Low immunisation levels in children and adults
- Poor hygiene, particularly hand washing practices (Baker et al. 2013).

The Community Health Baseline (Appendix B) indicates that the following factors are "at play" within the LNG Plant villages:

- Household occupancy sizes are between seven and nine depending on the specific village
- Wood is an extremely common fuel source for cooking
- Hygiene/sanitation levels at both village and household levels are low.

As such, despite some observed improvement in housing standards (primarily through the adoption of corrugated iron roofing) the basic household living conditions that enable transmission of ARI and tuberculosis remain in place.

The increased availability of RDTs for malaria has resulted in cases of fever, which have typically been reported as malaria being attributed to other causes most commonly respiratory illnesses. Morbidity data for the LNG Plant villages indicates that the prevalence of ARIs as a cause. Respiratory illness can be caused by many different aetiologies, including numerous species of bacteria, virus, protozoa, and fungi. Although bacterial pathogens, particularly *Hemophilus influenzae* and *Streptococcus pneumoniae*, are typically

identified as the major cause of acute lower respiratory illness, viral agents are also considered important agents in the disease process. Child and adult vaccination rates for measles, diphtheria, pertussis, and haemophilus influenzae type and pneumonia in LNG Plant villages are variable.

Regarding the Project, the nation-wide prevalence and thus risk of introduction and transmission of tuberculosis represent the greatest potential concern. The results of the PNG IMR study (2011 to 2018) clearly documented that a substantial tuberculosis problem was present across the LNG Plant villages, and passive case finding alone was insufficient to characterise the magnitude of the burden of tuberculosis. A “tuberculosis knowledge, attitude, and practice” survey for the LNG Plant villages demonstrated that LNG Plant villages had relatively good knowledge of tuberculosis causation (bacteria - 79%), transmission (airborne - 84%) and risk factors (living with tuberculosis patient - 85%), and how to reduce transmission (cover mouth while coughing - 61%).

However, less than 50% of LNG Plant village residents knew that crowded housing was a tuberculosis transmission risk factor (43%), or that a HIV+ status was a risk factor (15%), and that Bacille Calmette-Guerin (BCG) vaccination could decrease tuberculosis risk (17%). In addition, a substantial number of respondents held the following misperceptions/misbeliefs: tuberculosis transmission could occur with food sharing (41%), inherited within the family (38%), and skin contact transmission could occur.

The Project may be associated with an increased risk and frequency of tuberculosis and respiratory diseases through the in-migration of people to the area and reduced out-migration levels. For example, Project-induced in-migration from the Gulf Province has the potential to result in the entry and settlement of migrants who have tuberculosis and exacerbate overcrowding within households. Similarly, reduction in out-migration levels – reportedly in response to the availability of services – may exacerbate over-crowding. Together these processes may heighten the risk of spreading tuberculosis, COVID-19, and other respiratory diseases (Yates et al. 2016; Hemer, 2020). The potential for an increase in tuberculosis is recognised to be heightened for impoverished households, as there is a recognised relationship between malnutrition, overcrowding, and tuberculosis incidence (Hemer 2020).

Overall, the magnitude of the potential increases in respiratory illness within the LNG Plant communities from the Project's activities is expected to be medium, resulting in a potential impact with a **high significance**, as shown in Table 13.21. This impact ranking is primarily driven by potential significant consequences associated with an outbreak of respiratory illnesses.

Sanitation-related diseases

The Community Health Baseline (Appendix B) addresses water, sanitation, and hygiene (WASH)-related diseases referring to diseases that are transmitted directly or indirectly through contaminated water, soil, or non-hazardous waste (such as diarrhoeal diseases).

The LNG Plant villages' primary sources of water included piped supply taps, rainwater tanks, and tube wells. Water quality and reliability from sources in Boera and Porebada were reported to be poor with some requiring filtering and/or treatment before use. Approximately 80% of water sources in Lea Lea were reported to be of good quality; however, some pipes and/or taps are not well maintained with residents complaining that the water has poor taste and quality. In Papa, most water sources (90%) were reported to be well-maintained, reliable, and of good quality. The tube well located in the north of the village supplies most of the village, with approximately 60 households drawing from it twice a day as a primary water source.

Households surveyed in Porebada and Lea Lea reported the highest levels of use of mangroves and/or the sea for human waste disposal, at 61% and 45%, respectively. Households in Boera and Papa reported the highest use of pit toilets, 64% and 66%, respectively. The highest level of communal toilet use was reported in Lea Lea and Papa, which also had a major outbreak of cholera in 2010 linked to poor sanitation due to the absence of proper toilets (The National 2010).

Over the years there have been substantial interventions in LNG Plant villages targeting improvement in household and community water and sanitation including:

- Installation of community handwashing stations
- Distribution of WASH kits and outreach
- Community-led total sanitation WASH programs
- Training of community-based WASH champions (both men and women).

Despite these interventions, the Community Health Baseline (Appendix B) indicates that diarrhoeal disease remains an important cause of outpatient morbidity for the LNG Plant villages.

The Project's construction phase may be associated with an increase in diseases that are linked to poor sanitation, including dysentery, cholera, typhoid and intestinal worm infections (Keenan 2017). This may occur through an increase in the population of the LNG Plant villages driven by PIIM primarily associated with demand for labour and goods and services. Increased population pressure may adversely impact sanitation and thus transmission and occurrence of sanitation-related diseases through a number of change mechanisms, generally related to an increase in pressure on existing infrastructure (such as communal toilets and pit latrines, which may result in failures of these facilities (e.g., overflow)), an increase in the use of open defecation (i.e., the use of mangroves and sea) and an increased likelihood of contamination of water sources for drinking, bathing and washing.

Overall, the magnitude of the potential increases in diseases within the LNG Plant communities from the Project's activities are expected to be medium, resulting in a potential impact with a **high** significance, as shown in Table 13.21. This impact ranking is primarily driven by potential significant consequences associated with an outbreak of sanitation-related diseases.

Traffic accidents and injuries

As detailed in Appendix D Traffic and Land Use, the Lea Lea Road is the only link between Port Moresby and the LNG Plant. The road supports connectivity for a range of users, including a number of users that increase the presence and pedestrian use of the road, such as public motor vehicle stops, and roadside stalls.

The average daily traffic was calculated to be 1,933 vehicles per day along the Lea Lea Road, from the vicinity of Baruni Road junction (Motukea Port entrance) to the LNG Plant (approximately 17 km). The condition of the road varies, with a number of areas heavily pot-holed in poor condition.

An estimated 200,000 tonnes of cargo are expected to be imported through Motukea Port over the four-year construction period. The bulk of cargo will be shipped and transported to the LNG Plant site in the second year of construction (with a conservative peak of approximately 100,000 tonnes in quarter four of year two, though notably less during other periods) and move by truck along the highway each month, with approximately 500 truck movements per month, equating to around 17 truck movements per day. Haulage of modules and other large equipment such as compressor packages and gas turbine generators will require approximately 20 movements over a period of approximately three months.

Based on the generally accepted relationship between traffic volumes and accident frequency (Retallack and Ostendorf, 2020), an increase in traffic along Lea Lea Road may increase the incidence of traffic accidents and injuries along Lea Lea Road. However, the level of traffic generated by the Project will equate to an increase of the average daily traffic along Lea Lea Road of around 1% over current traffic volumes. The increase in traffic and therefore increased risk of traffic accidents and injury due to the Project is expected to primarily occur during the Project's construction period. Overall, the magnitude of a potential increase in traffic accidents is expected to be medium, resulting in a potential impact with a **high** significance, as shown in Table 13.21.

Mitigation and management measures

The measures proposed to mitigate and manage the Project's potential direct and indirect impacts on community health and the relevant management plan that these measures will be incorporated are summarised in Table 13.18.

Table 13.18 Community health – management response

Potential impact	Mitigation and management measures
Increased incidence of mosquito-borne diseases	The Community Health, Safety and Security Management Plan includes measures to manage the potential impacts from the construction of the Project on community health. These measures include: • Develop vector breeding source reduction procedures around Project activities to reduce vector proliferation. EMPNGA and the Contractor will identify activities that may result in vector proliferation and will develop appropriate procedures to control and monitor vector proliferation. • Incorporate health design specifications into facility and infrastructure design. • Develop an integrated malaria and vector control management plan that includes chemical control, case diagnosis and management, and workforce education. • EMPNGA will consult with health stakeholders and evaluate the support community malaria programs. The Requirements for Camps and Accommodations document includes measures to manage potential impacts from construction of the Project on community health. These measures include: • The contractor will supply suitable accommodation, including insecticide treated bed nets, for all workers (expatriates, other country nationals and national workforce). • The construction accommodation camp will be designed and implement appropriate controls to mitigate and reduce the development of mosquito populations.
Increased incidence of tuberculosis and respiratory diseases	The Project Induced In-migration Management Plan includes measures to limit in-migration. These measures include: • Minimising the incentive for in-migration through developing and communicating clear practices for recruitment, contracting, camp management and workforce accommodation, site access, and transport and logistics. • EMPNGA will work with key stakeholders and LNG Plant communities to identify community infrastructure and resources that may need additional support in each specific community due to the effects of PIIM. This may incorporate a range of actions as agreed with LNG Plant communities, including but not limited to the development of strategic plans to provide for adequate access to and maintenance of community services, infrastructure and resources, including but not limited to housing, water and sanitation, education and health care. • EMPNGA will work with key stakeholders and LNG Plant communities to: ○ Identify potential PIIM and work with key stakeholders (government and LNG Plant community leaders) and Project functions to create systems to deter PIIM. ○ Promote multi-stakeholders involvement and management of potential PIIM impacts and opportunities. • Develop PIIM indicators for monitoring and reporting across the Project's construction and where appropriate, operation. The Community Health, Safety and Security Management Plan includes measures to manage the potential impacts from the construction of the Project on community health. These measures include: • Develop and implement a workforce tuberculosis program that includes Project workers, all contractors and local laborers. The program will include pre-

Potential impact	Mitigation and management measures
	employment testing requirements, vaccination requirements, education, medical clearance requirements, and outbreak management response. EMPNGA will consult with health stakeholders and evaluate the opportunity to develop a Community Tuberculosis Control Program as an extension of the workplace program.
Increased incidence of sanitation-related diseases	The Project Induced In-migration Management Plan includes measures to limit in-migration. These measures include: - Minimising the incentive for in-migration through developing and communicating clear practices for recruitment, contracting, camp management and workforce accommodation, site access, and transport and logistics. - EMPNGA will work with key stakeholders and LNG Plant communities to identify community infrastructure and resources that may need additional support in each specific community due to the effects of PIIM. This may incorporate a range of actions as agreed with LNG Plant communities, including but not limited to the development of strategic plans to provide for adequate access to and maintenance of community services, infrastructure and resources, including but not limited to housing, water and sanitation, education and health care. - EMPNGA will work with key stakeholders and LNG Plant communities to: - Identify potential PIIM and work with key stakeholders (government and LNG Plant community leaders) and Project functions to create systems to deter PIIM. - Promote multi-stakeholders involvement and management of PIIM impacts and opportunities. - Develop PIIM indicators for monitoring and reporting across the Project's construction and where appropriate operation. The Community Health, Safety and Security Management Plan includes measures to manage the potential impacts from the construction of the Project on community health. These measures include: - Develop and implement an infectious disease outbreak management program for workers to reduce and respond to outbreaks. - Undertake longitudinal monitoring of water conditions in consultation with relevant community stakeholders. - EMPNGA will consult with relevant stakeholders and to evaluate the need for water, sanitation and hygiene (WASH) projects in LNG Plant communities. - Identify Project medical services capability and capacity that is necessary to screen for sanitation related diseases that may pose an infectious risk or has outbreak potential to the workforce and potentially, the surrounding communities. - Conduct education campaigns in the workforce on proper water use, hygiene and sanitation. - Provide worker accommodation camps and work areas with sufficient potable water facilities, and conducting monitoring and surveillance activities to ensure water is potable.
Increased incidence of traffic incidents	The Community Health, Safety and Security Management Plan includes measures to manage potential impacts Project-related traffic. These measures include: - Limiting the movement of workers and contractors to defined Project areas, using designated transport and transportation routes. - Implementing a convoy system for vehicles with significant loads where travel through communities is required. - Enforcing speed restrictions on roads to minimise potential environmental and social impacts.

Potential impact	Mitigation and management measures
	• Avoiding night driving as much as possible and implementing reduced speeds for night driving. • Enforcing drug and alcohol policies for all work-related vehicles, including contractor transport vehicles. • Developing and implementing driver competency requirements. All personnel will be required to demonstrate compliance with these requirements. The Contractor will maintain records of non-compliance and report these to EMPNGA monthly. • Establishing and monitoring driver hours and conditions to avoid driver fatigue. • Developing and implementing a driver code of conduct. The Contractor will maintain records of non-compliance and report these to EMPNGA monthly. Contractors will develop a disciplinary procedure (subject to EMPNGA approval) that will identify the process that will be followed if workers do not adhere to any code or rules and regulations. • Conducting traffic safety awareness training and community engagement programs within LNG Plant communities. • Working with local authorities and emergency services to prepare contingency plans to enable the passage of emergency vehicles during construction periods.

Residual impact assessment

The Project's potential direct and indirect impacts on community health will be managed through a range of measures designed to protect community health from the Project's activities and changes in the environment. Community health indicators have been assessed separately and as follows:

- **Mosquito-related diseases:** as outlined in the Community Health, Safety and Security Management Plan, ExxonMobil will develop an integrated malaria and vector control management plan that includes chemical control, case diagnosis and management, and workforce education, in addition to measures to prevent the development of mosquito breeding grounds during design. Following the implementation of these measures, it is expected that the potential incidence of mosquito-borne diseases related to Project activities will be reduced, and where it occurs managed so as to reduce the potential for an outbreak. Similarly, the potential for an in-migrating population to introduce mosquito-borne diseases will be managed through the Project Induced In-migration Management Plan, including measures to reduce the potential for in-migration.
- **Tuberculosis and respiratory and sanitation-related diseases:** the Community Health, Safety and Security Management Plan includes measures to manage tuberculosis within the workforce. The risk of respiratory and sanitation-related diseases is primarily associated with the potential in-migration of people to the area and reduced out-migration levels, and potential impacts on community resources and overcrowding. The Project Induced In-migration Management Plan includes measures to reduce the potential for in-migration, and measures to support community resources should in-migration occur.
- **Traffic incidents:** it is assumed that the potential for traffic accidents from Project-traffic will be effectively reduced from the implementation of measures within the Community Health, Safety and Security Management Plan.

Consequently, the Project's potential impacts on community health are rated as follows and summarised in Table 13.21:

- The magnitude of the potential for an increased incidence of mosquito-borne diseases is expected to reduce from **medium to very low**, resulting in a potential impact with **low significance**.

- The magnitude of the potential for an increased incidence of tuberculosis and respiratory diseases is expected to reduce from **medium to very low**, resulting in a potential impact with **moderate significance**.
- The magnitude of the potential for an incidence of sanitation-related diseases is expected to reduce from **medium to low**, resulting in a potential impact with **moderate significance**.
- The magnitude of the potential for an increased incidence of traffic incidents is expected to reduce from **medium to low**, resulting in a potential impact with **moderate significance**.

13.1.4.5 Social value 5: the availability of services and institutions supportive of community wellbeing

This section considers how the Project's activities may affect the availability of services and institutions supportive of community wellbeing. The attributes that contribute to this social value that may be affected by the Project's activities, directly or indirectly, include the use of the Port Moresby-Lea Lea Road for traffic and connectivity and public services.

Traffic and connectivity

As detailed in Appendix D Traffic and Land Use, the Lea Lea Road is the only link between Port Moresby and the LNG Plant. The road supports connectivity for a range of uses, including:

- Connecting the villages of Porebada, Boera, Kouderika, Koukou, Ranu Habadi, Bogi, Baruni, Kanudi, Papa, Lea Lea, and Edai Town to Port Moresby.
- Connecting commercial uses to the LNG Plant and Port Moresby, including the Motukea Port, Napa Napa Oil Refinery, and the Total Waste Management industrial waste facility at Roku.

The Lea Lea Road between the Motukea Port and the LNG Plant was largely resurfaced to support the PNG LNG Project; however, the current condition of the road varies, with a number of areas in poor condition and heavily pot-holed. The underlying sensitivity of the community use of the road has been rated as **sensitive**. Use of the road by emergency services is rated as **very sensitive**.

Mechanism of change

The Lea Lea Road will be upgraded to accommodate heavy and/or overweight vehicles and transport of large modules required for the Project's construction.

An estimated 200,000 tonnes of cargo is expected to be imported through Motukea Port over the four-year construction period. The bulk of the cargo will be shipped and transported to the LNG Plant site in the second year of construction (with a conservative peak of approximately 100,000 tonnes in quarter four of year two, though notably less during other periods) and moved by truck along the highway each month, with a peak of approximately 500 truck movements per month or around 17 movements per day.

Potential impact

An increase in traffic and road rehabilitation may result in several social impacts, including:

- An increase in travel times and reduced accessibility during construction
- An improvement in travel times due to road improvements.

The upgrade of Lea Lea Road is expected to result in temporary delays for other road users. Following these upgrade works, road users may experience temporary and minor delays due to the transport of wide loads. Similarly, the increase of traffic along Lea Lea Road may result in temporary and short delays due to congestion. Overall, several of the Project's construction activities are expected to result in temporary and short delays across the construction phase, which may result in increased travel times for other commercial

and industrial users of the Lea Lea Road, and community users of the road. Although this generally will result in minor changes to people's day to day lives for a short period of time, it is acknowledged that Lea Lea Road is the only connection between the local study area and health services in Port Moresby, and the use of the road by emergency services is time sensitive, and travel delays may result in increased response times, if otherwise un-mitigated.

The effect of these delays will be temporary and infrequent and are not expected to result in any material change to the community or commercial access to Port Moresby or services within the local area. Consequently, the magnitude of these changes to the road and traffic conditions for the general community and commercial users are expected to be low, resulting in a potential impact with a **low significance**, as shown in Table 13.21. However, the magnitude of these changes on emergency services and their users are expected to be medium, resulting in a potential impact with a **high significance**.

The upgrade of the Lea Lea Road will result in improved travel experience along the road for the community and other commercial and industrial road users, including reduced wear and tear on vehicles, and may reduce travel times for those using the road. However, based on the current state of the road, it is expected that the continued maintenance of these roads post-construction will prove to be challenging for local authorities, as evidenced by the deteriorating condition of Lea Lea Road, particularly between Baruni and Napa Napa Road junctions. Overall, the magnitude of the potential changes in improved transportation access from road maintenance are expected to be low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

Mitigation and management measures

The measures proposed to mitigate and manage the Project's potential impacts on traffic and connectivity and the relevant management plan that these measures will be incorporated are summarised in Table 13.19.

Table 13.19 Traffic and connectivity – management response

Potential impact	Mitigation and management measures
Increased travel times along Lea Lea Road during construction affecting general community and emergency services users.	The Community Health, Safety and Security Management Plan includes measures to manage potential impacts from Project-related traffic. These measures include: • Limiting the movement of workers and contractors to defined Project areas, using designated transport and transportation routes. • Working with local authorities and emergency services to prepare contingency plans to enable the passage of emergency vehicles during construction periods. • Identifying alternative transport routes to Lea Lea Road to avoid lane closures while upgrading Lea Lea Road.

Residual impact assessment

The Project's potential impacts on travel times along Lea Lea Road will be managed through measures proposed as part of the Community Health, Safety and Security Management Plan. As noted above, the upgrade of Lea Lea Road may result in temporary delays for other road users, however alternative transport routes will be identified, therefore delays to other road users, including emergency vehicles, will be avoided. Consequently, the Project's potential impacts on traffic and connectivity are rated as follows and summarised in Table 13.21:

- The magnitude of the potential increased travel times on Lea Lea Road for general users is expected to reduce from **low to very low**, resulting in a potential impact with **very low significance**.

- The magnitude of the potential increased travel times on Lea Lea Road for emergency services and their users is to reduce from **medium to very low**, resulting in a potential with **low significance**.

The potential for improved travel experience (e.g., comfort, vehicle wear and tear, and travel times) along Lea Lea Road due to road improvements by the Project is a beneficial and indirect impact, for which no further management measures have been proposed. Therefore, this potential impact has not been assessed further.

Access to and use of public services

As detailed in the Social Baseline (Appendix C), during the 2019 field investigations, it was reported that many of the schools required classroom maintenance and teacher accommodation. It is noted that EMPNG has contributed to projects to upgrade the staff accommodation at Lea Lea Primary School and Redscar High School, along with an expansion of Porebada Elementary School (Rina Consulting 2020; EMPNG 2022b). Data collected for the Social Baseline (Appendix C) found that there are relatively high rates of educational attendance in LNG Plant communities and that there has been a near doubling of enrolments within schools between data collected for the PNG LNG EIS and the field investigation for this EIS (2019). At the same time, the employment of teachers has not increased concomitantly, resulting in the average number of students per teacher growing from 24 in 2007 to 44 in 2019.

LNG Plant villages have, over time, had access to several aid posts (Boera) and sub-health centres (Papa and Porebada) although the Community Health Baseline (Appendix B) notes aid posts have staffing constraints. As a result, the Porebada Sub Health Centre has either closed or has irregular hours of operation and the Boera Aid Post has recently closed. Consequently, the burden of health care service and program delivery has primarily fallen on Papa Sub Health Centre which, together with the Boera Aid Post, is the primary health facility for the LNG Plant villages. Within this changeable context, the Community Health Baseline (Appendix B) indicates that health services are generally constrained by the lack of funding, staff, equipment and adequate medical supplies. The Community Health Baseline (Appendix B) indicates that, except for Porebada, most LNG Project village households use the medical services available within their geographical area. Porebada households make substantial use of other facilities (including both public and private services in the NCD), perhaps attributable to the irregular functionality of the health services.

The underlying sensitivity of the use and capacity of public services has been rated as **very sensitive**.

Mechanism of change

The Project's construction phase is likely to result in limited in-migration, with people (primarily men) arriving in search of Project-related employment. As noted in Section 13.1.2, this increase is expected to be temporary and minor. However, the continued expansion of the LNG Plant is expected to contribute to broader and indirect population growth and industrial development in the area, increasing the attractiveness of LNG Plant villages for in-migration.

The Project will need to assess whether it can increase the level of development funds available to the local level government.

Potential impact

Increased prevalence of health issues (such as respiratory illness, sanitation-related diseases, STIs and malaria), PIIM and increased Project-related benefit streams such as infrastructure grants are linked to several potential impacts on community wellbeing and local government support, including:

- Increased demand for education and health services due to an increase in population leading to a reduction in access, availability, and level of services.
- Increased demand for health services associated with potential Project-related health impacts (respiratory illness, sanitation-related diseases, STIs and malaria).
- Increased availability of funds to resource and maintain the capacity of community infrastructure.

- Reduced educational attendance due to improved employment prospects diminishing the perceived importance of educational attainment.

Increases in the population of LNG plant villages from PIIM or more generally associated with the broader development of the area will increase the demand for public services (e.g., education and health), resulting in a reduction in access, availability and/or level of services for the LNG Plant communities. As noted in Section 13.1.3, the level of PIIM as a result of the PNG LNG Project did not overwhelm the assimilative capacity of communities. Based on the trend demonstrated by the PNG LNG Project, the change in population due to PIIM will likely be of a moderate term and primarily focused on the Project's construction phase. The magnitude of the Project's potential impacts on the capacity of services to continue to support community wellbeing are expected to be medium, resulting in a potential impact with a **high significance**. This rating is based on a conservative estimate of the potential magnitude and impact of PIIM.

Broader development in the area (of which the PNG LNG Project contributed to) appears to have supported population growth and in-migration to the area, which has resulted in population growth without concomitant growth in some services. The Project is likely to contribute to the ongoing development in the area, which may continue to contribute to in-migration in the LNG Plant villages over the longer term. In contrast to PIIM, general in-migration is expected to be gradual. However, evidence suggests that the government of Papua New Guinea has not been able to support this growth in terms of expanding the capacity and ongoing resourcing of health and education facilities. Consequently, the magnitude of the Project's contribution to broader in-migration and the subsequent decrease in access to health and education facilities is expected to be low, resulting in a potential with a **moderate significance**, as shown in Table 13.21.

Benefits streams, such as infrastructure grants, associated with the PNG LNG Project have supported improvements to local community infrastructure and services, including improvements in healthcare centres, schools, water supply, and sanitation. However, there have been operational challenges with managing and maintaining these facilities; for example, government authorities have struggled to staff and provide supplies to a health centre established as part of the PNG LNG Project's benefit streams. These challenges have reduced the availability and level of services available to the communities; notwithstanding, these improvements have resulted in material improvements in community infrastructure and health outcomes within communities. Overall, the magnitude of the potential changes in community infrastructure and services from the Project's benefits streams are expected to be low, resulting in a potential with a **moderate significance**, as shown in Table 13.21.

There is some evidence that the presence of a large-scale resource sector project may result in lower levels of school attendance (Gylfason 2001), as improved employment prospects may diminish the perceived importance of education, particularly for students who are above the legal working age (16 years old). However, the evidence in Papua New Guinea is inconclusive, with school attendance improving in some communities proximal to large-scale resource projects. It is assumed that this is a result of improved household incomes and improvements to school infrastructure from infrastructure grants (Yamarak and Parton 2021). Overall, there is the potential for a reduction in school attendance, although it is expected that this will be tempered by other inducements for increased attendance, limiting the overall scale of the potential impact. The potential impact will likely primarily occur during the construction phase, when there is a greater level of potential employment opportunities with the Project. Overall, the magnitude of the potential changes in school attendance is expected to be very low, resulting in a potential impact with a **low significance**, as shown in Table 13.21.

Mitigation and management measures

The measures proposed to mitigate and manage the Project's potential direct and indirect impacts on access to and use of public services and the relevant management plan that these measures will be incorporated are summarised in Table 13.20.

Table 13.20 Access to and use of public services – management response

Potential impact	Mitigation and management measures
Reduced capacity of health and education services due to an increase in population.	The Project Induced In-migration Management Plan includes measures to limit in-migration and manage the potential impacts of in-migration on health and education services. These measures include: - Minimising the incentive for in-migration through developing and communicating clear practices for recruitment, contracting, camp management and workforce accommodation, site access, and transport and logistics. - EMPNGA will work with key stakeholders and LNG Plant communities to identify community infrastructure and resources that may need additional support in each specific community due to the effects of PIIM. This may incorporate a range of actions as agreed with LNG Plant communities, including but not limited to the development of strategic plans to provide for adequate access to and maintenance of community services, infrastructure and resources, including but not limited to housing, water and sanitation, education and health care.
Increased availability of funds to resource and maintain the capacity of community infrastructure.	The Community Development Support Plan includes measures to support the expansion of healthcare and education services and promotes the benefits of achieving secondary education in the LNG Plant villages, including: ExxonMobil will direct community investment to education and health initiatives that will support the identified needs and priorities of affected communities and will complement the role and responsibility of the Government of Papua New Guinea. Long-term projects will be selected on their capacity to become self-perpetuating and not dependent on long-term funding.
Reduced educational attendance due to the Project's employment opportunities.	

Residual impact assessment

The Project's potential direct and indirect impacts on community access to and use of public services will be managed through a range of measures that are designed to limit in-migration and measures to support community resources should in-migration occur. Specifically, reduced capacity of health and education services due to in-migration will be managed by providing additional support to identified community infrastructure and resources, where appropriate. On this basis, the magnitude of potential impacts on access to and use of public services due to in-migration has been reduced. In addition, the Community Development Support Plan includes measures designed to promote the benefits of obtaining secondary education in LNG Plant communities. Consequently, the Project's potential direct and indirect impacts on access to and use of public services are rated as follows and summarised in Table 13.21:

- The magnitude of the potential reduced capacity of health and education services due to an increase in population is expected to be reduced from **medium to very low**, resulting in a potential impact with a **low significance**.
- The magnitude of the Project's contribution to broader in-migration and the subsequent decrease in access to health and education facilities is expected to remain low, resulting in a potential impact with a **moderate** significance.
- The magnitude of the potential reduced school attendance due to Project employment opportunities is expected to remain very low, resulting in a potential impact with a **low** significance.

The potential for the availability of funds to resource and maintain the capacity of community infrastructure and their users is a potential beneficial impact, for which no further management measures have been proposed. Therefore, this potential impact has not been assessed further.

13.1.4.6 Impact assessment summary

Table 13.21 summarises the Project's potential social impacts, including their initial and residual significance.

Table 13.21 Impact assessment summary

Potential impact	Impact direction	Sensitivity	Initial significance		Residual significance	
			Magnitude rating	Significance	Magnitude rating	Significance
National and provincial impacts						
Social value 2: the availability of opportunities to participate in the cash economy						
Increased opportunities to participate in wage-based employment during the Project's construction.	Positive	Sensitive	Medium	Moderate	High	High
Increased opportunities to participate in wage-based employment during the Project's operation.	Positive	Sensitive	Low	Low	Medium	Moderate
Increased opportunities to improve vocational skills during the Project's construction.	Positive	Sensitive	Low	Low	Medium	Moderate
Increased opportunities to improve vocational skills during the Project's operation.	Positive	Sensitive	Medium	Moderate	High	High
Increased opportunities for women to participate in formal employment during the Project's construction and operation.	Positive	Very sensitive	Low	Moderate	Medium	High
Increased demand for enterprise-based services from Papua New Guinean suppliers during construction.	Positive	Sensitive	Low	Low	Medium	Moderate
Increased demand for enterprise-based services from Papua New Guinean suppliers during operation.	Positive	Sensitive	Low	Low	Medium	Moderate
Increased capacity of enterprises.	Positive	Sensitive	Low	Low	Medium	Moderate
Reduced availability of skilled workforce for other industries.	Negative	Sensitive	Low	Low	Low	Low
Social value 4: an environment supportive of personal, family and community health, safety, security and social wellbeing						
Decreased housing affordability as a result of increasing population size and housing demand.	Negative	Sensitive	Low	Low	Low	Low

Potential impact	Impact direction	Sensitivity	Initial significance		Residual significance	
			Magnitude rating	Significance	Magnitude rating	Significance
LNG Plant communities						
Social value 1: the capacity to support livelihoods based on the harvest of natural resources						
Reduced capacity of terrestrial resources to support livelihoods in LNG Plant communities during construction.	Negative	Very sensitive	Low	Moderate	Very low	Low
Reduced capacity of terrestrial resources to support livelihoods in LNG Plant communities during operation.	Negative	Very sensitive	Very low	Low	Very low	Low
Reduced capacity to support livelihoods due to reduced availability and access to marine resources.	Negative	Sensitive	Medium	Moderate	Low	Low
Social value 2: the availability of opportunities to participate in the cash economy						
Increased opportunities to participate in wage-based employment during the Project's construction.	Positive	Sensitive	Medium	Moderate	High	High
Increased opportunities to participate in wage-based employment during the Project's operation.	Positive	Sensitive	Medium	Moderate	High	High
Increased opportunities for women to participate in formal employment during the Project's construction and operation.	Positive	Very sensitive	Low	Moderate	Medium	High
Increased opportunities for skill development during the Project's construction.	Positive	Sensitive	Medium	Moderate	High	High
Increased opportunities for skill development during the Project's operation.	Positive	Sensitive	Medium	Moderate	High	High
Increased demand for goods and services in the informal economy due to the flow-on effects of Project employment and contracting opportunities.	Positive	Very Sensitive	Low	Moderate	Low	Moderate
Reduced opportunity to engage in informal economy activities for stallholders temporarily relocated to allow for road upgrade.	Negative	Very sensitive	Very low	Low	Very low	Low
Increased demand for enterprise-based services from local suppliers during construction.	Positive	Very sensitive	Low	Moderate	Medium	High

Potential impact	Impact direction	Sensitivity	Initial significance		Residual significance	
			Magnitude rating	Significance	Magnitude rating	Significance
Increased demand for enterprise-based services from Papua New Guinean suppliers during operation.	Positive	Very sensitive	Low	Moderate	Medium	High
Increases in capacity of enterprises.	Positive	Very sensitive	Low	Moderate	Medium	High
Increased household incomes for landowners from royalty and equity payments.	Positive	Very sensitive	Very low	Low	Very low	Low
Social value 3: the ability to sustain cultural identity and traditions						
Reduced participation in the production of traditional handicrafts.	Negative	Sensitive	Low	Low	Very low	Low
Reduced ability of LNG Plant communities to access and sustain an attachment to land due to in-migration.	Negative	Sensitive	Medium	Moderate	Low	Low
Social value 4: an environment supportive of personal, family and community health, safety, security and social wellbeing						
Improved household access to food due to improved household incomes.	Positive	Very sensitive	Low	Moderate	Low	Moderate
Decreased household food access due to inflation from Project-induced economic activity.	Negative	Very sensitive	Low	Moderate	Very low	Low
Detrimental changes in rates of non-communicable diseases due to increased consumption of processed foods.	Negative	Very sensitive	Medium	High	Low	Moderate
Decreased food security following retrenchment of the workforce.	Negative	Very sensitive	Medium	High	Low	Moderate
A reduction in marine safety.	Negative	Very sensitive	Medium	High	Low	Moderate
Reduced perception of safety.	Negative	Very sensitive	Medium	High	Low	Moderate
An increase in crime and public disorder.	Negative	Very sensitive	Medium	High	Low	Moderate

Potential impact	Impact direction	Sensitivity	Initial significance		Residual significance	
			Magnitude rating	Significance	Magnitude rating	Significance
An increase in family and sexual violence.	Negative	Extremely sensitive	Medium	High	Low	Moderate
Decreased community marine safety due to increased ship traffic	Negative	Very sensitive	Low	Low	Low	Low
An increase in sexually transmissible infections.	Negative	Very sensitive	Medium	High	Low	Moderate
An increase in single mothers due to an increased incidence of transactional sex.	Negative	Very sensitive	Medium	High	Low	Moderate
An increase in sexual exploitation from the presence of an external workforce.	Negative	Very sensitive	Medium	High	Low	Moderate
Decreased community cohesion due to unequal distribution of Project's employment and business development opportunities.	Negative	Very sensitive	Medium	High	Low	Moderate
Reduced personal security due to the use of excessive force by the RPNGC or the Project's security personnel.	Negative	Very sensitive	Medium	High	Low	Moderate
Decreased amenity within LNG Plant villages due to the LNG Plant construction.	Negative	Sensitive	Low	Low	Very low	Low
Decreased amenity for sensitive receptors due to the widening of Lea Lea Road.	Negative	Sensitive	Low	Low	Very low	Low
Increased incidence of mosquito-borne diseases.	Negative	Very sensitive	Medium	High	Very low	Low
Increased incidence of tuberculosis and respiratory diseases.	Negative	Very sensitive	Medium	High	Very low	Low
Increased incidence of sanitation-related diseases.	Negative	Very sensitive	Medium	High	Low	Moderate
Increased incidence of traffic incidents.	Negative	Very sensitive	Medium	High	Low	Moderate

Potential impact	Impact direction	Sensitivity	Initial significance		Residual significance	
			Magnitude rating	Significance	Magnitude rating	Significance
Social value 5: the availability of services and institutions supportive of community wellbeing						
Increased travel times on Lea Lea Road for the general community.	Negative	Sensitive	Low	Low	Very low	Very low
Increased travel times on Lea Lea Road for emergency services users.	Negative	Very sensitive	Medium	Moderate	Very low	Low
Improved transportation access from road maintenance.	Positive	Sensitive	Low	Low	Low	Low
Reduced capacity of health and education services due to project-induced in-migration.	Negative	Very sensitive	Low	Moderate	Very low	Low
Reduced capacity of health and education services due to indirect in-migration.	Negative	Very sensitive	Low	Moderate	Low	Moderate
Community infrastructure and services from the Project's benefits streams.	Positive	Very sensitive	Low	Moderate	Low	Moderate
Project employment opportunities reducing educational attendance.	Negative	Very sensitive	Very low	Low	Very low	Low

13.2 CULTURAL HERITAGE IMPACT ASSESSMENT

This section presents the selected approaches to cultural heritage impact assessment (Section 13.2.1), addresses the potential impacts or principal issues (Section 13.2.2), proposes mitigation and management measures (Section 13.2.3) and summarises potential residual impacts of project construction and operations to cultural heritage values (Section 13.2.4).

13.2.1 Approach to impact assessment

This section summarises the findings and assessments presented in the cultural heritage impact assessment report (Appendix A Cultural Heritage Impact Assessment). The cultural heritage study area for this assessment was defined by a 10 m buffer surrounding the terrestrial project footprint including all onshore project components as well as supporting and temporary facilities. The study area does not include offshore project components including the LNG Plant jetty extension or the offshore pipelines. The extent of the cultural heritage study area defined and investigated for the Project is shown in Chapter 10, Figure 10.1.

The impact assessment framework used in this study incorporates the following sequential elements:

1. Identification of the cultural heritage sites and values to be included in the assessment. For this study, these include all cultural heritage sites and values known to be located within the study area at the conclusion of the baseline characterisation.
2. Assessment of the significance of each cultural heritage site or value using established, internationally recognised criteria developed by Australia ICOMOS (the Burra Charter), as well as the opinions of the local communities.
3. Assessment of the magnitude of the impact from proposed Project activities on cultural heritage sites and values, based on an assessment of the severity, geographical extent, and duration of the impact.
4. Determination of the significance of a potential Project impact on identified cultural heritage sites and values, based on the consideration of the site's/value's cultural heritage significance and the magnitude of the impact it is likely to experience.
5. Identification of avoidance and management measures that, if implemented, could either avoid Project impacts to cultural heritage sites and values altogether or reduce the significance of these impacts.
6. Determination of residual Project-related impacts to cultural heritage sites and values by assessing the significance of a potential impact after the implementation of recommended avoidance and management measures.

Further detail on the study method applied for this cultural heritage impact assessment is provided in Chapter 10 Cultural Heritage Environment.

Assessing the significance of cultural heritage sites

The significance of the values of each cultural heritage site were individually assessed and rated as being either low, medium, or high according to the criteria set out in Table 10.3 (Chapter 10 Cultural Heritage Environment).

Assessing the magnitude of impact

The magnitude of an impact on a cultural heritage site or value is an assessment of the geographical extent, duration, and severity of the impact. The magnitude of the impact is determined before and after the application of management measures.

The impact magnitude criteria used in the cultural heritage impact assessment are presented in Table 13.22.

Given that the impact magnitude criteria identified below may not all apply equally in terms of their severity in any given instance, an overall impact magnitude rating was calculated based on the cumulative score for each criterion, as follows:

- Low (cumulative score ≤ 3)
- Medium (cumulative score between 4 and 6)
- High (cumulative score ≥ 7).

Table 13.22 Impact magnitude criteria and ratings

Criterion	Nil (Rating 0)	Low (Rating 1)	Medium (Rating 2)	High (Rating 3)
Severity	No impact	• Loss of up to one third of site contents. • Site condition rating decreases by one rating point. • Site representativeness rating unchanged. • Minor impact to the site's scientific value. • Minor community reaction; attracts stakeholder concern at a local level.	• Loss of up to two thirds of site contents. • Site condition rating changes by two rating points. • Site representativeness rating decreases. • Moderate impact to the site's scientific value. • Substantial community reaction; results in stakeholder concern at local and provincial levels.	• Loss of greater than two thirds of site contents. • Site condition rating changes by three rating points. • Site representativeness rating decreases. • Major impact to the site's scientific value. • Major community reaction; results in stakeholder concern at a national or international level (i.e., media, shareholder, government, international non-government organisation concern).
Extent	No impact	Impact damages less than one third of site. No loss of access to site.	Impact damages up to two thirds of site and/or access to site restricted.	Impact damages greater than two thirds of site and/or permanent loss of access to site.
Duration	No impact	Temporary or short-term impact or loss of access to site limited to Project construction phase.	Medium-term impact or loss of access to site that will alleviate within life of Project.	Long-term (extends beyond the life of the Project) or permanent impact.

Assessing impact significance

The matrix used to assess the significance of a project-related impact on a cultural heritage site or value is presented in Table 13.23. The significance of an impact is determined by assessing the significance of a cultural heritage site or value in relation to the overall magnitude of the expected impact on it.

Table 13.23 Impact significance assessment matrix

Magnitude of the impact	Cultural heritage site/value significance		
	High	Medium	Low
High	Extreme	Major	Moderate
Medium	Major	Moderate	Minor
Low	Moderate	Minor	Negligible
Nil	Nil	Nil	Nil

Source: Appendix A Cultural Heritage Impact Assessment.

13.2.2 Potential impacts

Project activities have the potential to impact 333 cultural heritage sites, given that these sites either intersect the proposed Project disturbance footprint or are located within 10 m of the proposed Project disturbance footprint.

Tangible cultural heritage sites identified within the study area have the potential to be impacted by Project activities as a result of:

- Direct disturbance of archaeological site locations due to on-ground works including vegetation clearance, topsoil stripping, subsoil excavation and construction.
- Direct disturbance of archaeological sites due to the movement of Project workers and contractors and their vehicles (e.g., erosion).
- Direct disturbance of archaeological sites due to the movement of Project workers and contractors (e.g., erosion, unauthorised removal of artefacts).
- Restricted physical access of communities to archaeological sites due to project activities and operational requirements.

Direct impacts have the potential to affect cultural heritage sites in the following ways:

- Loss of connection between people and their places of cultural value through the destruction or damage of a site.
- Loss of information which could otherwise be gained by conducting research today.
- Loss of the archaeological resource for future research using methods and addressing questions not available today.
- Permanent loss of the physical record.

As noted in Appendix A Cultural Heritage Impact Assessment, most (if not all) of the 251 archaeological sites that were identified during the preparation of the PNG LNG Project EIS, which are situated west of the LNG Plant's perimeter fence within the current study area were either disturbed or destroyed during construction of the facility in 2010-2012. Appropriate cultural heritage management responses to potential impacts associated with the PNG LNG Project construction phase were implemented under requirements of the approved PNG LNG Project Cultural Heritage Management Plan (CHMP).

On this basis it was deemed unlikely that the construction and operation activities of the Project will further impact the 244 sites situated within the Project impact footprint west of the perimeter security fence. These sites have therefore not been included in this impact assessment.

The cultural heritage significance of the 88 sites located within the laydown area outside the fence included in the impact assessment was assessed using the criteria presented in Chapter 10. All but one of the archaeological sites (DS021), were assessed as being of low cultural heritage significance. Results of the impact assessment show that the potential for significant impacts to cultural heritage sites was assessed as Moderate in all instances except for DS021, which was assessed as being Major.

13.2.3 Mitigation and management measures

Based on the outcomes of the cultural heritage consultations, fieldwork and subsequent significance assessment process (see Chapter 10 Cultural Heritage Environment), the Project will update the existing PNG LNG Project CHMP to include new cultural heritage sites.

The following management commitments pertaining to CHMP requirements will mitigate the potential impacts identified in Section 13.2.2.

- All requirements of the PNG LNG Project CHMP will be implemented with regard to cultural heritage sites situated within the Project impact footprint within the perimeter security fence.
- Develop and implement a cultural awareness program for all employees and contractors.
- Specify salvage activities (whether it be surface artefact collections or subsurface archaeological excavations) where required, including but not limited to:
 - Development of an appropriate salvage methodology to be implemented prior to ground disturbing Project activities commencing.
 - Establishing specific measures for the exhumation of any human remains that may be unearthed as chance finds or during cultural heritage salvage investigations.
- Require the implementation of the PNG LNG Project CHMP Chance Finds Protocol with clear processes for reporting, investigation and management of cultural heritage chance finds discovered during Project-related activities.
- Maintain a cultural heritage site database and update the database as new information becomes available. The database will inform further planning and design and will assist in the implementation of recommended management measures. It will include the precise locations of all sites, particularly those to be avoided.
- Require engagement with men and women in local communities regarding the:
 - Content of the project-specific Cultural Heritage Management Plan, including the community engagement methods that will be employed in recognition of community values.
 - Development of culturally appropriate methods for the practical management of cultural heritage sites that are to be protected from impacts.
 - Development of appropriate management measures in relation to their oral tradition sites. Culturally appropriate responses to the management of sites and places that would be unavoidably impacted by Project-related activities may include avoidance, exhumation/relocation of the site and traditional ceremonies (that should precede the commencement of Project-related activities).

The site-specific management measures proposed in Table 13.24 have been developed drawing on the outcomes of the baseline assessment (including the 2019 cultural heritage field investigation program) described in Chapter 10 Cultural Heritage Environment, the results of the impact assessment reported in Section 13.2.2, and consideration of the impact management responses contained in the PNG LNG Project EIS and CHMP for sites relating to the Project study area. Table 13.24 only includes sites where specific mitigation has been proposed to manage potential impacts; Appendix A Cultural Heritage Impact Assessment provides a full list of sites included in the impact assessment.

Requirements for preconstruction salvage method are as follows:

- Salvage works that are recommended prior to the commencement of construction-related activities within the laydown study zone will be agreed by NMAG for high significant sites.
- Representatives of local village communities will be engaged to assist the salvage program.
- Salvage excavation at a cultural heritage site will be supervised by a suitably qualified archaeologist and conducted in a manner consistent with good industry practice.
- Salvage excavation will typically commence with a 1 m² (i.e., a 1 m x 1 m) salvage pit. Excavation will continue to a culturally sterile depth or to the maximum depth of construction impacts at that location. This will be agreed and determined onsite by the archaeologist and EMPNGA in consultation with the affected community representative(s).
- Where an archaeological deposit uncovered or partially uncovered in the 1 m² salvage pit is determined to be of high significance due to content, condition and representativeness, the salvage excavation may be extended as agreed with Papua LNG co-venture participants and the NMAG.
- It may be necessary to determine the site extent. In this case, a site boundary establishment program will be proposed by the archaeologist and undertaken subject to the agreement of the Papua LNG co-venture participants and the NMAG.
- Following the determination of site extent, if harm avoidance is achievable, no further salvage excavation is required.
- Guidance on the custodianship of recovered materials will be determined by the NMAG.

Table 13.24 Site-specific avoidance, management, and mitigation measures (ESSA study zone)

Field site code	NSF site code	Isolated artefact	Artefact scatter	Size	Density	Cultural heritage significance	Impact significance	Avoidance/ management/ mitigation measures
AK Road 1	-	No	Yes	Medium	Low	Low	Moderate	Collection of surface artefacts by an archaeologist prior to construction.
AK Road 2	-	No	Yes	Medium	Low	Low	Moderate	Collection of surface artefacts by an archaeologist prior to construction.
NA/AK 8.2	-	No	Yes	Medium	Low	Low	Moderate	Salvage excavation consistent with the salvage method prior to construction.
NA/AK 8.3	-	No	Yes	Medium	Low	Low	Moderate	Salvage excavation consistent with the salvage method prior to construction.
DS006	-	No	Yes	Small	Medium	Low	Moderate	Collection of surface artefacts by an archaeologist prior to construction.
DS021	-	No	Yes	Large	Low	Medium	Major	Avoid; confirmation of the site's location and boundary by an archaeologist; erection of a suitable barrier or other measures such as cultural awareness training to prevent access by Project employees and contractors prior to works commencing; reference to this site protection strategy in daily toolbox meetings. If avoidance is not possible, salvage excavation consistent with the salvage method prior to construction.
DS048	BXB	No	Yes	Medium	Low	Low	Moderate	Collection of surface artefacts by an archaeologist prior to construction.
DS070	ABXX	No	Yes	Medium	Low	Low	Moderate	Collection of surface artefacts by an archaeologist prior to construction.
DS071	ABXY	No	Yes	Medium	Low	Low	Moderate	Collection of surface artefacts by an archaeologist prior to construction.
DS081	ABYI	No	Yes	Small	Medium	Low	Moderate	Collection of surface artefacts by an archaeologist prior to construction.

13.2.4 Residual impact assessment

Prior to the implementation of the proposed management measures, 87 archaeological sites would have experienced impacts rated as Moderate, and one site (DS021) would have experienced impacts rated as Major.

Assuming the successful implementation of the avoidance, management and mitigation measures, residual impacts to the 88 sites included in the impact assessment are:

- The impact response for 78 sites (89%) is No Action given that these sites almost uniformly contain 10 or less artefacts and mostly comprise heavily weathered undecorated ceramic fragments. The impact significance for these sites remains unchanged (**Moderate**).
- The impact significance for nine sites (10%) is reduced from Moderate to **Minor**.
- The impact significance for site DS021 is reduced from Major to **Nil**.