TOTAL
TOTAL E&P PNG LIMITED

PAPUA LNG PROJECT

UPSTREAM ENVIRONMENTAL IMPACT STATEMENT

VOLUME 1: MAIN REPORT

Chapter 17: Impacts - Cumulative

TOTAL E&P PNG LIMITED

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17. Impacts: Cumulative

17.1 Context and Approach

Cumulative impacts are 'those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones' (IFC, 2013).

This chapter identifies PNG Government-approved or proponent-proposed projects that might cumulatively contribute to both positive and adverse impacts on the environmental, social and cultural values present in, or that are relevant to the Project area of influence (PAOI).

17.2 Discipline-specific Assessment Method

This cumulative impact assessment is based on the method in the Good Practice Handbook for Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (IFC, 2013) (hereafter the IFC Good Practice Handbook for Cumulative Impacts).

Under this guidance, priority for assessing and managing cumulative impacts is limited to those values or impacts generally recognized as important due to scientific concerns or concerns of Project-affected communities. This approach places key environmental, social and cultural values at the center of the assessment and iteratively reviews these in the context of other projects or proposals that might directly or indirectly impact on these values.

The assessment uses baseline information presented in Chapters 7 to 10, findings from the discipline-specific impact assessments presented in Chapters 11 to 16 and Chapter 18, and publicly available information on approved or proposed projects in the spatial boundaries set (Section 17.3).

The steps followed to scope, identify and assess cumulative impacts are presented graphically in Figure 17.1 and described in Sections 17.3 through 17.6.

17.3 Scoping the Assessment

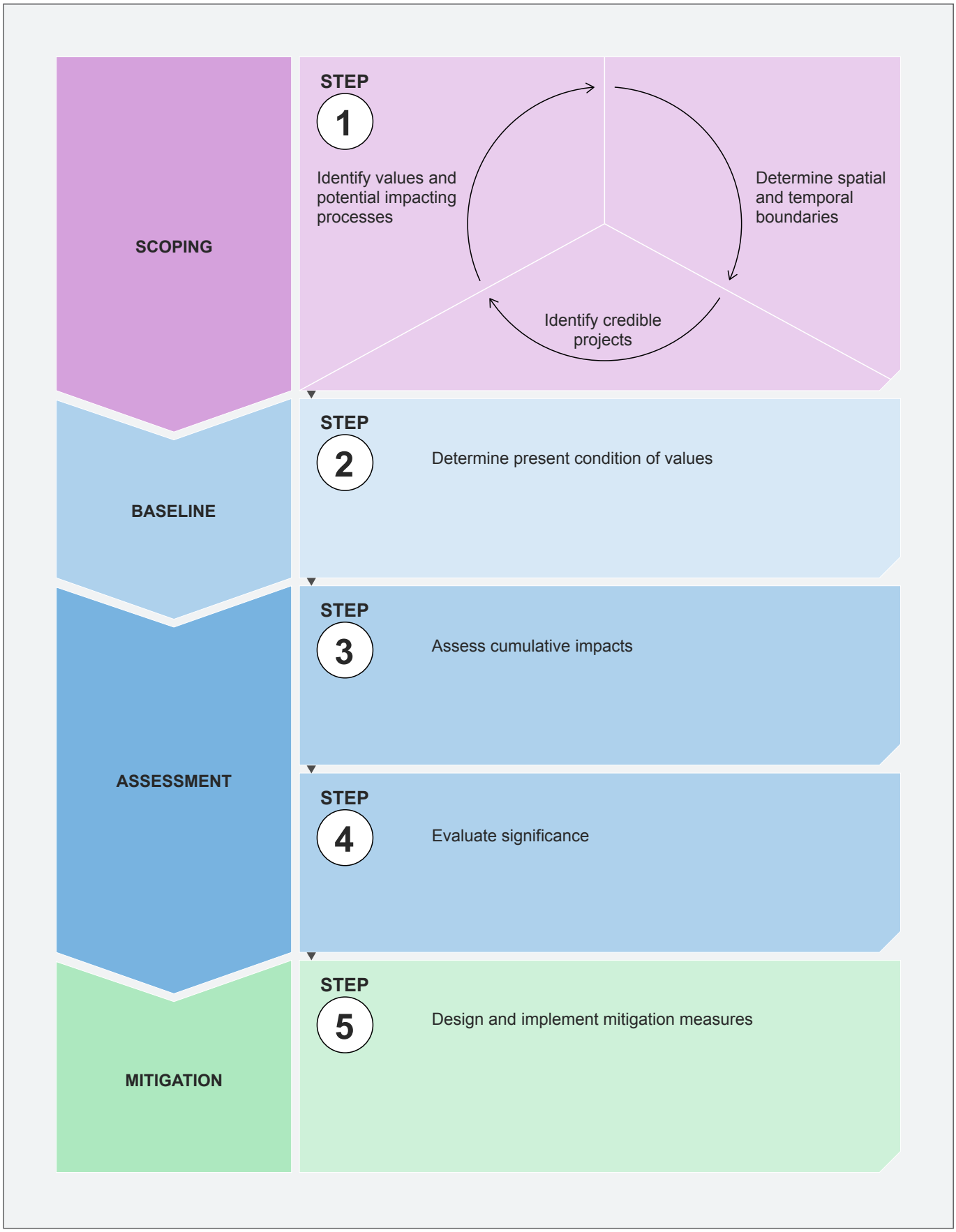
The cumulative impact assessment scope was determined by iteratively examining:

- The spatial boundaries, or geographical connections between Project activities and the identified values, which were derived by combining the PAOI with any likely pathways that would connect the PAOI with other projects, including catchments, transport corridors and access routes.
- The temporal boundaries, or the timeframe over which the analysis takes place, and which are defined as the expected life of the Project (i.e., 25 years), including construction, operations and decommissioning.
- Credible projects, which are defined as those that are existing, planned or reasonably anticipated based on publicly available information are:
  - Currently operating or are expanding.
  - Under construction or being commissioned.
  - Undertaking detailed feasibility studies or a small-scale pilot project in preparation for the full-scale project.
  - Approved by the PNG Government and awaiting final investment decision or are in the final design stages.
  - Midway through their environmental approvals process and are likely to proceed if a permit is granted.

CUMULATIVE IMPACTS ASSESSMENT PROCESS

Papua LNG Project | Environmental Impact Statement

FIGURE 17.1



Adapted from IFC (2013).

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These aspects of the scoping process identified seven existing, planned or reasonably anticipated projects, which are described in Table 17.1 and illustrated on Figure 17.2, and found six licence areas overlapping or adjacent to PRL-15 (Figure 17.3). Six projects are considered credible for the cumulative impact assessment, based on the criteria listed above.

The following were then identified to complete the iterative scoping process:

- The potential impacting processes that might contribute to a cumulative impact. These processes were derived from the impact assessments in Chapters 11 to 16 of this EIS. The information available on the specific activities or predicted impacts of the credible projects is limited, and so the relevance of the potential impacting processes to the credible projects was determined from professional expertise and an understanding of similar projects (e.g., PNG LNG Project, P'nyang Project). The potential impacting processes were refined to six processes that are considered relevant to the identified environmental, social and cultural values.
- The environmental, social, and cultural values that the potential impacting processes could affect. These were identified from Chapters 7 to 10 of this EIS and through engagement with stakeholders (described in Chapter 6).

The IFC Good Practice Handbook for Cumulative Impacts (IFC, 2013) describes 'valued environmental and social components' as 'environmental and social attributes that are considered to be important in assessing risks'. They may include:

- Physical features, habitats, and wildlife populations.
- Ecosystem services.
- Natural processes.
- Social conditions and local populations.
- Cultural aspects.

The term 'value' has been used in this chapter to encompass this definition and includes resources, sites, and other receptors (e.g., humans) as considered relevant.

Key values that could be subjected to cumulative impacts were identified by a team of specialists, drawing upon the environmental and social baseline studies (see Chapters 7 to 10) and the impact assessments undertaken for the Project (see Chapters 11 to 16).

A value was selected for consideration in this cumulative impact assessment when it was:

- Determined by impact assessment to be highly susceptible to change or disturbance.
- Likely to be subject to cumulative impacts (i.e., it exists or is likely to exist within the spatial boundaries).
- Identified by stakeholder engagement as having particular relevance to Project-affected communities (see Chapter 6).

A list of the potential impacting processes and the values that could potentially be affected by cumulative impacts is presented in Table 17.2.

Table 17.1 – Assessment of Potential Credible Projects

Company and Project	Description	Spatial Relationship	Temporal Relationship	In or Out of Scope
Rimbunan Hijau (PNG) Group (forestry) Frontier Holdings Ltd and Turama Forest Industries	♦ Rimbunan Hijau is a Malaysian logging company with two subsidiaries operating in the area; Frontier Holdings and Turama Forest Industries. ♦ Logs are transported from the logging area on barges along the Purari River distributaries.	♦ Frontier Holdings has been logging Vailala Blk 3 southeast of the Purari River, and Turama Forest Industries has a forest management agreement for Baimuru Block 3. ♦ Harvesting is expected to move north of the Purari River, including into areas of hill and alluvial forest in PRL-15, as the Baimuru Block 3 concession is developed.	♦ Vailala Block 3 and Baimuru Block 3 are currently operating; although Vailala Block 3 was reportedly winding down during the Project baseline studies in 2016 (see Part 7 and 18 Volume 2).	♦ In – Forestry operations are current and overlap with PRL-15.
Mayur Resources Bulk Coal Sample Extraction/Depot Creek Coal Project*	♦ Mayur Resources (via Waterford Ltd, its subsidiary) holds a portfolio of contiguous tenements that cover the main coal-bearing geology in the Papuan Basin in southern Papua New Guinea. ♦ Mayur Resources has been granted an environmental permit for coal bulk sample extraction for market and end-user testing in PNG's Gulf Province (exploration licence EL-1875), which includes the Depot Creek Coal Project. ♦ If the full-scale project goes ahead, an estimated 300,000 tonnes of coal would be produced annually to supply a coal-fired generator near Lae.	♦ EL-1875 is approximately 20 km south of Wabo, overlapping PRL-15. ♦ The Depot Creek Coal Project is located approximately 8 km west of PRL-15. ♦ Mayur Resources may use the Purari River to transport coal.	♦ The full-scale project has a projected 25-year life. ♦ It is unknown when the project will commence.	♦ In – The Depot Creek Coal Project meets the credible project criteria, and the licence area overlaps with PRL-15. ♦ The full-scale development is also considered in scope even though it will depend on the outcomes of bulk sample extraction.
Mayur Resources Orokolo Bay Industrial Sands Project*	♦ Mayur Resources' industrial sands tenement portfolio covers more than 12,000 km^2 along the southern coastline and delta regions of the Gulf of Papua. ♦ Mayur Resources is progressing the development of the Orokolo Bay Industrial Sands Project, with an initial plan for surface mining of five million tonnes per annum, from which a range of products, including zircon, would be produced.	♦ Mayur Resources' strategy prioritizes developing the Orokolo Bay Industrial Sands Project. ♦ Although the exact location is undefined, a small-scale bulk samples plant could be developed very close to the proposed offshore export pipeline shore crossing location.	♦ The project has commenced a definitive feasibility study (2018). ♦ It is unknown when the project will commence construction.	♦ In – The Orokolo Bay Industrial Sands Project meets the credible project criteria.

Table 17.1 – Assessment of Potential Credible Projects (cont'd)

Company and Project	Description	Spatial Relationship	Temporal Relationship	In or Out of Scope
Mayur Resources Central Cement and Lime Project*	♦ Mayur Resources is developing a high-grade limestone deposit. ♦ The Central Cement and Lime Project has received an Environmental Permit to extract, process and manufacture quicklime, clinker and cement, to transport product and to build infrastructure. ♦ The resource is expected to produce quicklime, clinker and cement for the domestic market or for export to the Pacific region and Australia.	♦ Located in Central Province, 7 km northwest of the PNG LNG Facilities and 25 km from Port Moresby. ♦ The Central Cement and Lime Project will likely use the Gulf of Papua for shipping.	♦ The project has a projected 25-year life. ♦ The project has commenced a definitive feasibility study (2018). ♦ It is unknown when the project will commence construction.	♦ In – The Central Cement and Lime Project meets the credible project criteria.
ExxonMobil PNG Ltd LNG Facilities#	♦ ExxonMobil PNG Ltd operates the PNG LNG Facilities in Caution Bay. ♦ These facilities are planned to be expanded to receive gas and condensate from the Project (i.e., the upstream facilities of the Papua LNG Project) and the P'nyang Project.	♦ The PNG LNG Facilities are at the southern extent of the Project area, approximately 20 km northwest from Port Moresby, in Caution Bay. ♦ The Project's condensate and gas pipelines will terminate at the LNG plant, which will undergo an expansion to support additional trains to process the gas.	♦ The PNG LNG Facilities are currently operating.	♦ In – The PNG LNG Facilities meet the credible project criteria.
P'nyang Project	♦ The proposed P'nyang Project will commercialize natural gas resources in the P'nyang gas field in the Western Province of Papua New Guinea. ♦ The project comprises a range of onshore infrastructure required to recover and process gas and condensate from the gas field, and to transport gas to the existing PNG LNG Facilities near Port Moresby. ♦ The condensate will be commercialized through the existing oil export infrastructure at the Kutubu Central Processing Facility and Kumul Marine Terminal (operated by Oil Search Limited).	♦ The P'nyang Project gas field and proposed conditioning plant are approximately 400 km northwest of the Project area. ♦ The P'nyang Project will use the Gulf of Papua for shipping condensate.	♦ The P'nyang Project construction period is estimated to commence in 2019 and last four to five years. ♦ The project has a projected 30-year life.	♦ In – The P'nyang Project meets the credible project criteria.

Table 17.1 – Assessment of Potential Credible Projects (cont'd)

Company and Project	Description	Spatial Relationship	Temporal Relationship	In or Out of Scope
Ihu Special Economic Zone (ISEZ)^	♦ The Ihu ISEZ is a Kikori District government initiative to encourage economic growth by facilitating resource development projects in the area. ♦ The ISEZ will consist of a free trade zone, petroleum park, industrial zone, technology park, forestry park, marine park, a deep sea port and airport, a township with hotels and resorts, and a government and administration area.	♦ The ISEZ is in the PAOI, just west of the Vailala River in the Kikori District.	♦ There is no publicly available date to begin construction.	♦ Out – The ISEZ is currently a master plan with no known financial commitments by the PNG Government.

* Information sourced from Mayur Resources (2018)
# Information sourced from ExxonMobil (2019)
^ Information sourced from Kikori District (2019)

POTENTIAL CREDIBLE PROJECTS WITHIN THE SPATIAL BOUNDARIES

Papua LNG Project | Environmental Impact Statement

FIGURE 17.2

LICENCES OVERLAPPING OR ADJACENT TO PRL-15

Papua LNG Project | Environmental Impact Statement

FIGURE 17.3

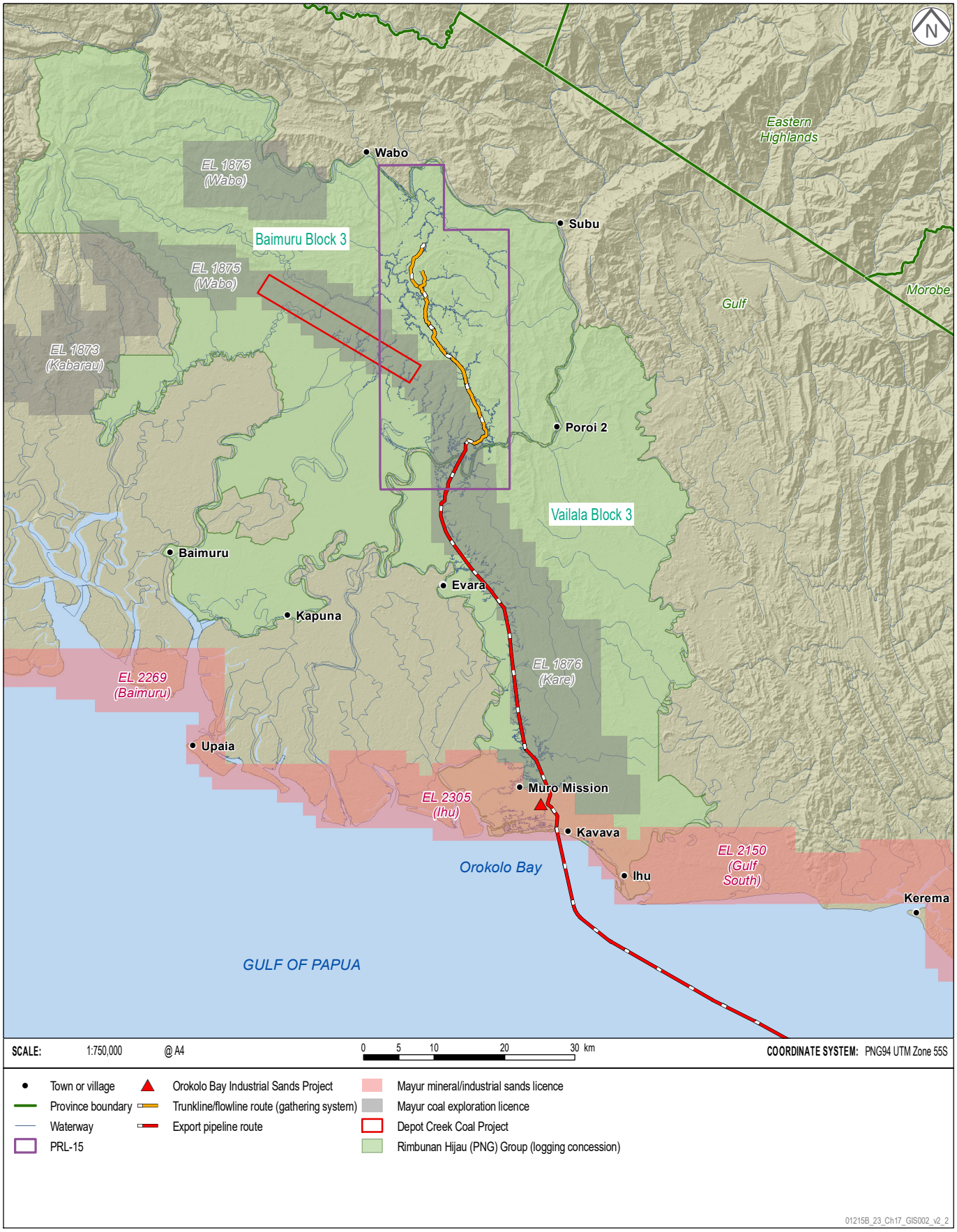

Table 17.2 – Potential Impacting Processes and Values Potentially Impacted

Process	Environmental, Social and Cultural Values
Development of a fossil fuel resource.	♦ Climate change and climate regulation.
Vegetation clearing and habitat disturbance.	♦ IUCN Threatened species, and other Very and Extremely Sensitive species. ♦ Sensitive focal sites and ecosystems. ♦ Landscape character. ♦ Use of land/water for livelihoods (i.e., hunting, collecting wild plants, loss of gardens).
Contamination or sedimentation of marine or surface water.	♦ Water quality. ♦ Drinking water. ♦ Use of land/water for livelihoods (i.e., fishing, hunting, harvesting sago). ♦ IUCN Threatened species, and other Very and Extremely Sensitive species.
Increased pressure on transport corridors and infrastructure.	♦ Commercial transport (shipping, air transport) ♦ Community health and wellbeing. ♦ Use of land/water for livelihoods (i.e., loss of access to waterways, loss or damage to assets). ♦ IUCN Threatened species, and other Very and Extremely Sensitive species. ♦ Sensitive focal sites and ecosystems. ♦ Economic security
Population growth (in-migration and induced access).	♦ Sensitive focal sites and ecosystems. ♦ Access to health and education services. ♦ Community health and wellbeing. ♦ Traditional practices and language.
Economic stimulus, benefits distribution.	♦ Community health and wellbeing. ♦ Economic security.

Note: IUCN = International Union for the Conservation of Nature.

The potential impacting processes are described further in the following subsections.

17.3.1 Development of a Fossil Fuel Resource

The credible projects outlined in Table 17.1 will contribute to Papua New Guinea's greenhouse gas (GHG) emissions inventory and to anthropogenic climate change through the extraction, combustion and/or emission of GHGs and land use change.

17.3.2 Vegetation Clearing and Habitat Disturbance

While, vegetation and habitat loss or disturbance may be minor on a project-by-project basis, the cumulative loss and fragmentation of native vegetation associated with multiple projects could be significant, particularly in areas that support Critically Endangered species or sensitive focal sites or ecosystems.

The Project area is in largely undisturbed forest, of which approximately 930 ha will be cleared for Project infrastructure, which is less compared with existing and planned resource projects, e.g., the Wafi-Golpu project EIS identified a clearing footprint of approximately 1,400 ha (WGJV, 2018) and the PNG LNG project EIS identified approximately 1,800 ha for the onshore upstream elements of their project (CNS, 2009).

Commercial logging operations use selective timber harvesting, which opens the forest canopy but does not clear-fell forest habitat. Deforestation does occur in the PAOI for logging roads and is estimated to clear 206 ha/year (Part 7 of Volume 2). Small areas are also cleared for subsistence agriculture or settlement expansion.

17.3.3 Contamination or Sedimentation of Marine or Surface Waters

The residual impact significance of Project-related discharges to the Purari River or to the nearshore marine environment in Orokolo or Caution bays have been assessed in Chapter 11 as ***Minor*** to ***Moderate***; however, discharges from multiple projects occurring simultaneously could cause a higher significance rating.

Potential contaminating discharges include hydrotest waters, treated effluent, contaminated stormwater and accidental hydrocarbon or chemical releases, all of which have the potential to degrade water quality.

The Project will involve dredging at the Logistics Base, land clearing, and earthworks, including trenching at the export pipeline shore crossings, all of which could increase suspended sediment and sedimentation levels in fresh or marine waters.

Credible projects operating in and around PRL-15, on the Purari River and on the Gulf of Papua are likely to generate similar discharges.

17.3.4 Increased Pressure on Transport Corridors and Infrastructure

River and marine traffic have the potential to increase the risk of vessel collisions, increase the chance of vessel-related spillages or discharges, and disturb existing river users and riverway or coastal communities. Vessel traffic may also aid the spread of invasive species, which can threaten biodiversity and subsistence activities.

The primary Project transport corridors are the nearshore marine shipping route (Route 6, Figure 10.7) and the Purari River. It is likely that a cumulative increase in both river and marine traffic will occur, as the credible projects listed in Table 17.1 ramp up.

Credible projects are likely to require their workforces to transit through Port Morseby international airport, which could cause congestion and delays, if not appropriately planned for and managed.

17.3.5 Population Growth

Infrastructure development for resource projects can increase access to relatively inaccessible areas, providing increased opportunities for hunting, fishing, exploitation of forest resources, and clearing of land for gardens and houses. Population movements associated with resource projects can also place pressure on existing communities (e.g., community cohesion, food and water supplies, spread of diseases) and improve the ability of people to reach health and education services.

Population influx, due to Project-related workforces and other people seeking employment or other economic opportunities occurs, can place pressure on resident populations and ecosystems (see Chapter 13). In-migration and workforce movement are typically highest during project construction. Consequently, the highest potential for cumulative impacts occurs when construction of multiple projects coincides or overlaps. This is difficult to predict for the credible projects listed in Table 17.1, as publicly available information is scarce and most projects are still in the early planning stages. An examination of small-scale mining operations, like those proposed by Mayur Resources (i.e., coal and industrial sands), indicates that a large workforce is unlikely to be required.

17.3.6 Economic Stimulus

Most resource projects can stimulate local, regional and national economic activity. Provincial and local-level governments will receive direct financial benefits through royalties and development

levies, and indirect financial benefits from the stimulation of economic activities. The extent local communities experience this stimulus depends on how governments allocate these royalties.

Additional economic benefits may include increased training, trade and employment opportunities facilitated by government and private investment in public infrastructure and services, and through direct and indirect employment.

The Project will generate financial benefits to Papua New Guinea that will increase gross domestic product and national government revenue. Much of the 2014 and 2015 growth in the PNG economy is attributed to the PNG LNG project (WBG, 2019) and the Papua LNG and P'nyang projects are likely to offer significant employment opportunities during construction.

17.4 Determining the Present Condition and Sensitivity of Key Values

Step 2 of the cumulative impact assessment process (see Figure 17.1) establishes a baseline for the cumulative impacts by determining the present condition of the values identified in Step 1 and listed in Table 17.2. The cumulative impact assessment focuses on understanding whether cumulative impacts will affect the sustainability or viability of a value, as indicated by its predicted or measured condition. The sensitivity reflects the value's resilience to change, (which may change over time as more projects progress in the area), importance to Project-affected communities, uniqueness or rarity, and intrinsic worth. It builds on existing definitions of valuable social and environmental components described in the International Finance Corporation's (IFCs) performance standard 6 (IFC, 2012).

The baseline studies and advice from technical specialists informed the sensitivity of each of the key values. The sensitivity ratings used for the key values listed in Table 17.2 are described in Table 17.3; and a summary of the baseline characteristics, sensitivity ratings and relevant trends affecting these values is provided in Table 17.4.

Table 17.3 – Value Sensitivity Rating Criteria

Sensitivity Rating	Description
High	♦ Limited or no resilience. ♦ Value is largely unaffected to date by the potential impacting processes. ♦ The value is largely unmodified with few local or regional replacements, is sensitive to disturbance and requires intervention to recover. ♦ The value is ecologically or socially important on a national level. ♦ A value upon which local people frequently depend for provision of food or income.
Medium	♦ Some resilience. ♦ The value shows some sign of exposure to the potential impacting processes. ♦ The value has not been significantly altered but has local or regional equivalents. ♦ The value is ecologically or socially important on a regional level. ♦ A value upon which local people occasionally depend for provision of food or income.
Low	♦ High resilience. ♦ Value has already been affected by exposure to the potential impacting processes. ♦ A modified or degraded value with some original qualities but is significantly altered. ♦ The value generally enriches or maintains the local area. ♦ A value upon which local people rarely depend for provision of food or income.

Table 17.4 – Key Values: Sensitivity, Baseline Condition and Trends

Key Value	Sensitivity	Baseline Condition	Trends
Physical and Environmental			
Greenhouse gas (GHG) emissions and climate change	Medium	♦ The Land Use, Land Use Change and Forest sector is one of the biggest sectors in Papua New Guinea's GHG emission inventory and has historically acted as a sink. ♦ Estimated GHG emissions from the energy sector increased notably in 2014 and 2015 due to increasing demand for electricity, and increased fugitive emissions associated with increasing natural gas production.	♦ Over the last century, the burning of fossil fuels (which primarily comprise carbon) has increased global atmospheric CO_2 concentration, which contributes to an observed enhancement of the natural greenhouse effect, (i.e., climate change). ♦ Some of the global trends observed in the global climate system include (IPCC, 2014): – Warming of the atmosphere and oceans. – Loss of ice mass in Greenland and Antarctic ice sheets. – Increasing rate of sea level rise. – Increase of atmospheric CO_2, CH_4, and N_2O concentrations to levels unprecedented in at least the last 800,000 years.
IUCN Threatened species, and other Very and Extremely Sensitive species	High	♦ Baseline biodiversity studies have identified the following Threatened or Sensitive species in the terrestrial biodiversity study area: – Three IUCN Critically Endangered terrestrial species and one Extremely Sensitive new-to-science restricted-range plant. – Four IUCN Critically Endangered aquatic species either known, likely or considered possible in the Project area. – Nine IUCN Endangered and 17 IUCN Vulnerable terrestrial species confirmed present or likely to occur in the Project area. A further 37 restricted-range, new-to-science and undescribed species considered to be Very Sensitive are also present. – Two aquatic insect species identified as endemic to the Papuan Gulf Coastal Lowlands.	♦ Endangered and threatened species are at a high or extremely high risk of extinction in the wild. ♦ Habitat loss, degradation and fragmentation; logging; harvesting; and hunting and fishing are key threats.
Sensitive focal sites and ecosystems	High	♦ Baseline biodiversity studies have identified the following sensitive focal sites and ecosystems in the terrestrial biodiversity study area: – Oxbow lakes and wetlands, mangroves, primary alluvial forest, hill forest on limestone and the Purari River tidal wetlands are Very Sensitive ecosystems.	♦ These focal sites and ecosystems are highly sensitive to disturbance with low replacement and recovery potential. ♦ Clearing, habitat degradation, logging, anthropogenic disturbances, hydrological change, invasive alien species competition and erosion are key threats.

Table 17.4 – Key Values: Sensitivity, Baseline Condition and Trends (cont'd)

Key Value	Sensitivity	Baseline Condition	Trends
Physical and Environmental			
Sensitive focal sites and ecosystems (cont'd)	High	– Two IUCN Threatened freshwater turtle nesting sites and two freshwater crocodile nesting sites occur in the Project area. – Caves are also present and are considered Very Sensitive. The Wi'l Creek cave site is Extremely Sensitive. – Three Very Sensitive terrestrial ecosystems are present: Hill forest on limestone (H), primary Alluvial forest (P) and Mangrove (M).	♦ These focal sites and ecosystems are highly sensitive to disturbance with low replacement and recovery potential. ♦ Clearing, habitat degradation, logging, anthropogenic disturbances, hydrological change, invasive alien species competition and erosion are key threats.
Water quality	Medium	♦ Freshwater lakes, rivers and streams, and forest pools in the PAOI generally contain low nutrient and organic carbon levels and low metal concentrations. ♦ Turbidity is high in the Purari River year-round, but peaks during the northwest monsoon season. ♦ Large turbid inflows from the Purari and Vailala rivers reduce water quality in Orokolo Bay. ♦ No evidence was found of anthropogenic contamination of marine waters.	♦ Commercial logging is likely to increase turbidity in PAOI rivers as natural erosion control is lost. ♦ Eutrophication, contamination from runoff, sedimentation, water abstraction, loss or damage to riparian vegetation, erosion and anthropogenic disturbances are key threats.
Social and Cultural			
Landscape character	Medium	♦ No developments of a comparable scale or form to the Project currently exist in the provincial and local setting, and forestry is the primary anthropogenic landscape impact.	♦ The landscape character is becoming more industrialized as more development occurs in areas that are otherwise relatively untouched.
Use of land/water for livelihoods	Medium	♦ People in the PAOI significantly depend on natural resources for survival and wellbeing. ♦ Livelihoods are dominated by subsistence activities, including gardening or hunting, gathering or fishing for wild foods. ♦ Planting and harvesting sago are important food production activities. ♦ Plant and animal resources are highly valued and universally used across the PAOI for construction, hunting and fishing, medicine, domestic items, canoes, firewood and cultural celebrations.	♦ Papua New Guinea relies on subsistence agriculture to feed approximately 80% of its population (Hayward-Jones, 2016). ♦ Successful farmers in Papua New Guinea complain that the younger generation is not interested in tending to family gardens or in commercial agricultural ventures (Hayward-Jones, 2016).

Table 17.4 – Key Values: Sensitivity, Baseline Condition and Trends (cont'd)

Key Value	Sensitivity	Baseline Condition	Trends
Social and Cultural (cont'd)			
Community health and wellbeing	Medium	♦ Diseases are already present in the PAOI. Malaria and tuberculosis are prevalent, with tuberculosis at epidemic levels. ♦ HIV/AIDS and other sexually transmitted diseases are highly prevalent. Accidents and injuries (associated with marine and river traffic or household activities) are an under-appreciated morbidity burden across the PAOI (i.e., 5 to 10% of health center morbidity caseload). ♦ Betel nut, a known human carcinogen, and alcohol, tobacco and marijuana are likely contributors to non-communicable diseases in the PAOI.	♦ A diet based on subsistence agriculture has helped Papua New Guineans avoid the increase of diet-related non-communicable diseases, such as obesity and Type 2 diabetes, that have afflicted their neighbors in Polynesian and Micronesian states. ♦ The number of people affected by non-communicable diseases, including cardiovascular and respiratory disease, cancer, and diabetes, is increasing (Hayward-Jones, 2016).
Access to health and education services	Medium	♦ Health and education facilities in the PAOI are limited and inadequate in some places (particularly in the north), with several facilities only being partially open and others being closed. ♦ Limited transport options mean many communities must travel significant distance by either boat or foot to access health services, with many turning to traditional medicines as a result. ♦ Education and literacy levels are low throughout the PAOI, particularly in the more remote inland areas.	♦ Government expenditure on health as a proportion of total expenditure has increased (Hayward-Jones, 2016). ♦ Papua New Guinea's schooling system has suffered from policy shifts, major curriculum changes and under-resourcing (Hayward-Jones, 2016).
Drinking water	Medium	♦ The most common source of drinking water in the PAOI is rainwater, rivers and streams, including the Purari River, and shallow wells (more common in Orokolo Bay communities). ♦ Microbial quality is poor, with high levels of coliforms detected at most sites.	♦ Strong population growth may have contributed to downward trends in water and sanitation coverage (WHO/UNICEP, 2010).
Traditional practices and language	Medium	♦ PAOI communities practice traditions and customs, including traditional song, dance and dress, ritual practices, oral traditions, and traditional subsistence knowledge such as traditional medicines.	♦ As communities lead less traditional lifestyles, with access to increased income and consumables, many traditional practices throughout the PAOI are declining.

Table 17.4 – Key Values: Sensitivity, Baseline Condition and Trends (cont'd)

Key Value	Sensitivity	Baseline Condition	Trends
Social and Cultural (cont'd)			
Traditional practices and language (cont'd)	Medium	♦ There are seven language groups in the PAOI; Pawaia, Koriki, Iare, Ahia, Kaimare, Maipua and Orokolo.	♦ Communities affected by changing economic situations and in-migration have identified that the use of traditional language is being eroded, and a lack of access to education and employment opportunities is a key factor drawing young people away from villages and compromising the maintenance of traditional languages (Part 17 of Volume 2).
Economic security	Medium	♦ The national traditional economy is based on subsistence farming. ♦ The main industries in Gulf Province are oil and gas extraction, prawn fishing and logging. The province contains five large-scale logging operations; however, benefits from logging are invisible at the community level and the provincial government does not benefit financially. ♦ The greatest contribution to the national economy in 2016 was oil and gas (28% of GDP) followed by agriculture, forest and fisheries (21%) and construction (15%). ♦ Economic infrastructure in the PAOI is limited: No public roads, two small remote airstrips (Purari and Wabo), electricity only from petrol-fired generators or solar power, and no banks or postal services.	♦ The national economy depends heavily on the resources sector, having become focused on petroleum and gas-related activities since 2014 (World Bank Group, 2019). ♦ The growing employment age population has limited formal job opportunities. ♦ Preliminary estimates suggest that real GDP growth slowed from 2.8% in 2017 to 0.3% in 2018, following a contraction in the extractive sector due to the February 2018 earthquake. This is forecast to rebound during 2019 (World Bank Group, 2019).
Commercial transport (i.e., marine and river transport, air transport)	Low	♦ Three shipping routes occur in the PAOI, namely two coastal shipping routes (i.e., barge traffic to Herd Base and logging barges to a logging camp near Evara village) and one international shipping lane (to the PNG LNG marine terminal in Caution Bay). ♦ The Gulf of Papua Prawn Fishery operates a fleet of eight trawlers in the Gulf of Papua.	♦ Logging transport is predicted to continue at the same rate as measured during the Project baseline surveys, i.e., 24 return trips per year between Evara and the Purari River delta. ♦ The Project is predicted to increase use of the Purari River by up to 540 vessel movements per year during peak construction. ♦ The Depot Creek Coal Project may use the Purari River to transport coal. ♦ The P'nyang Project could increase barge trips over its construction period. These barges will likely use the Port Moresby to Kiunga shipping route, which in 2017 had approximately 212 return barge trips per year. ♦ The Mayur Resources projects are likely to involve shipping of coal to Lae and Asian markets, and mineral sands to Australia.

17.5 Potential Cumulative Impacts on Key Values

Step 3 of the cumulative impact assessment process (see Figure 17.1) involves identifying and assessing the potential cumulative impacts of the potential impacting processes on key values and qualitatively evaluates the significance (Step 4) of the potential cumulative impacts where possible. This is consistent with standard industry practice, where the details of developments (e.g., exact locations and footprints, workforce, emissions etc) are not publicly available.

The potential impacts are described, assuming that all of the mitigation measures and embedded design controls outlined in Chapters 11 to 16 of this document have been implemented.

17.5.1 Climate Change and Climate Regulation

Project-related vegetation clearing, gas production, transportation and the operation of fixed and mobile equipment will generate an estimated 20.7 Mt of CO_2-e Scope 1 GHG emissions over the life of the Project. This increases to 61.4 Mt of CO_2-e if the estimated emissions from downstream processing are included.

This compares with predicted Scope 1 emissions for the PNG LNG Project (excluding the expansion due to the Papua LNG Project) of 77.4 Mt of CO_2-e over the 30-year project life (ExxonMobil, 2019).

The Project's GHGs will contribute to Papua New Guinea's national emissions. Chapter 15 identifies that the maximum annual Scope 1 GHG emissions estimated for the Project are 1.48 Mt of CO_2-e., representing a 9.8% increase in the total reported national Papua New Guinea GHG emissions of 15.1 Mt CO_2-e (based on 2015 data).

Emissions from the Project and other credible projects identified in Table 17.1 will contribute to global greenhouse gas concentrations that influence global atmospheric processes and changes to the global climate system (see Part 5 of Volume 3).

Project-related clearing will remove more native forest that acts as a GHG sink, as more resource projects are developed in Papua New Guinea. The Land Use, Land Use Change and Forestry sector is one of the largest sectors in Papua New Guinea's GHG emission inventory and historically has acted as a sink. Due to increasing rates of deforestation and forest degradation, this sector has become an increasingly smaller sink over time; and in recent years, this sector has been a net source of GHGs. This is a significant contributor to Scope 1 emissions (e.g., Project clearing accounts for 62% of construction-related emissions).

17.5.2 Sensitive Species

Sensitive species could be threatened by cumulative clearing of habitat, by direct loss (i.e., through hunting or tree removal), or from indirect effects, such as population increase, increased human activity (such as boat traffic) and land use changes.

17.5.2.1 IUCN Critically Endangered Species

The little known and Critically Endangered timber tree species (*Diospyros lolinopsis*) occurs in primary alluvial forest along the Project onshore export pipeline route. The Project will avoid individuals of this species as far as practicable; however, credible projects that enable greater access to this habitat increase the risk of spreading weeds and increase accessibility to timber and forest products, with the potential for direct loss or indirect (disturbance-related) impacts reducing local numbers of this species.

Bulmer's fruit bat (*Aproteles bulmerae*) is known from only a few restricted areas of Papua New Guinea outside the PAOI. The credible projects listed in Table 17.1 are unlikely to directly destroy

or damage potential roosting and maternity caves; however, cumulative impacts to Bulmer's fruit bat may occur from improved access and population influx, increasing hunting pressure on the species. Hunting has already significantly reduced the species population and distribution (see Chapter 7).

The tree *Guioa hospita* is potentially present in the Project study area in hill and alluvial forest. Logging, particularly in Baimuru Block 3, could cause extensive degradation to these habitat types and the loss of or damage to individuals. Degrading or removing the habitat of this rare and poorly known species or the loss of even a few individuals could threaten the viability of the population.

The largetooth sawfish *(Pristis pristis*) and the northern river shark *(Glyphis garricki*) may occur in the main channels of the Purari River. The Purari River is a key transport corridor for the Project, local communities, the logging industry and potentially the Depot Creek Coal Project. These species may be susceptible to increased boat traffic and a decline in water quality from effluent discharges and from runoff from washdown, waste, processing and chemical facilities. While the Project's potential contribution to the deterioration of surface water quality has been assessed as ***Negligible*** to ***Minor*** for most activities, future cumulative impacts of multiple projects operating simultaneously could impact water quality to an extent that adversely affects these species (Section 17.3.3).

17.5.2.2 IUCN Endangered and Vulnerable Species

A high species diversity, including several IUCN Endangered and Vulnerable species and other Very Sensitive species, are known from the foothill zone on well-drained primary alluvial forest and in the area identified by Mayur Resources for their Depot Creek Coal Project (see Figure 17.3).

These species include the IUCN Endangered *Diospyros insularis* and the IUCN Vulnerable lowland tree kangaroo (*Dendrolagus spadix*) and Scheepmaker's crowned pigeon (*Goura scheepmakeri*). Habitat degradation or loss caused by vegetation clearing and the constructing access tracks could cause injury to or loss of individuals and a potential decline in population viability.

The IUCN Endangered giant bandicoot (*Peroryctes broadbenti*) may occur along the southern half of the onshore export pipeline route where a Mayur Resources Industrial Sands tenement is also located (see Figure 17.3). While the habitat loss due to Project activities is minimal, cumulative clearing could contribute to a degradation or loss of habitat that could cause injury to or loss of individuals and a potential decline in population viability.

Habitat loss or degradation may be further compounded by logging activities and increased access to the region along logging tracks; although, these impacts will likely be localized to areas around access routes. No information is available relating to improved land access (i.e., roads or tracks) for Mayur Resources projects in the area. Logging operations are likely to continue to open up new tracks into unlogged hill forest in and around PRL-15.

The lowland tree kangaroo, giant bandicoot and Scheepmaker's crowned pigeon are also sensitive to hunting. If the Project, Mayur Resources projects and logging projects collectively improve access for hunters or increase village populations, an increase in hunting could reduce local species populations. The cumulative impacts on these species may reduce population viability given their sensitivity to disturbance, low population densities and habitat specificity.

Potential cumulative impacts to the IUCN Endangered speartooth shark *(Glyphis glyphis*) will be like those of the Critically Endangered northern river shark (Section 17.5.2.1).

17.5.2.3 Extremely Sensitive Species

The terrestrial herb *Begonia* sp. 5 is an endemic, new-to-science, riparian specialist known from only a few individuals along the northern edge of the central processing facility footprint. If the species is also found in the proposed footprints or areas of operational influence of credible projects and is constrained to a local or small geographical area, the cumulative loss of individuals could reduce the regional population viability.

17.5.2.4 Commercially Important Species – Tropical Rock Lobster

The presence of the PNG LNG and the Project pipelines crossing the tropical rock lobster migration route to spawning grounds near Yule Island has the potential to cumulatively reduce the number of migrating lobsters reaching the spawning area and successfully spawning, and thus the catches of and possibly participation in the artisanal and Torres Strait commercial lobster fisheries. The assessment of potential cumulative impacts is limited by currently unknown potential impacts of the existing PNG LNG Gas Pipeline on lobster migration.

17.5.3 Sensitive Focal Sites and Ecosystems

17.5.3.1 Sensitive Focal Sites

The IUCN Endangered pig-nosed turtle (*Carettochelys insculpta*), the IUCN Vulnerable striped New Guinea soft-shelled turtle (*Pelochelys bibroni*) and freshwater crocodile use the Purari River and its tributaries for nesting sites.

Additional boat traffic associated with multiple projects using the Purari River as a transport route may increase the likelihood of boat strike and subsequent injury to, or loss of individuals. Boat wash could also damage banks used for nesting, which could reduce the viability of these populations.

17.5.3.2 Sensitive Ecosystems

Three Very Sensitive terrestrial ecosystems are present in the Project terrestrial biodiversity study area: Hill forest on limestone (H), primary (unlogged) Alluvial forest (P) and Mangrove (M).

While the predicted vegetation loss in these ecosystems due to Project activities is minimal (i.e., 0.13% of primary alluvial forest, less than 0.01% of mangrove and no direct impacts to hill forest on limestone), cumulative clearing associated with the credible projects identified as overlapping with the PAOI (see Figure 17.3) could contribute to an unsustainable loss of these ecosystems.

Degradation due to edge and barrier effects, and the introduction and spread of invasive alien species will add to any direct loss of sensitive ecosystems from clearing.

17.5.4 Water Quality

Chapter 11 assesses the residual significance of increased suspended sediments and sedimentation in Oyomo Creek, Mena River, Kuku Creek and Boa Creek as moderate. The Purari River is already highly turbid throughout most of its main channel; however, sedimentation due to Project activities is unlikely to affect the channel.

Other resource projects operating in or around PRL-15 (e.g., Depot Creek Coal Project and commercial logging operations) during the same period as the Project's construction phase could contribute to cumulative sediment loading in creeks in the Project area. Changes related to increased sediment loads, were they to occur, are unlikely to be enduring provided disturbed areas are either actively revegetated or left to naturally regenerate.

Accidental release of hazardous materials could occur during the construction, operations and decommissioning phases, and has been assessed as a residual moderate risk for the Project (Chapter 11). An increase in use of the Purari River for transport could increase the potential for accidental discharges occurring from spills during fuel or chemical transfer from barges or from accidents. Hazardous materials could also enter the waterway in runoff during significant rainfall and flooding.

While the residual impact significance has been assessed as ***Negligible*** or ***Moderate*** in the context of the Project's activities (see Chapter 11), where several projects are operating in the one catchment, cumulative discharges, when they occur at the same time near each other, have the potential to degrade water quality for downstream users, including communities reliant on the Purari River for domestic water supply. Provided other projects implement similar management measures as those outlined in Chapter 11, hazardous material releases entering the waterway at the same time and location are unlikely to occur.

17.5.5 Landscape Character

The Gulf Province landscape is typical of Papua New Guinea and comprises mountainscapes that rapidly give way to coastal lowlands. Anthropogenic disturbances, such as extensive commercial logging, infrastructure development and vegetation clearance for oil and gas exploration activities, and previous and contemporary commercial plantations (e.g., coconut) closer to coastal areas, are present.

Impacts to landscape character refer to the relative capacity of the landscape to accommodate the introduction of new features and the loss or modification of existing features, such as those due to Project development.

Multiple resource projects occurring in a relatively natural landscape can change landscape character. Native vegetation removal; natural landform changes (e.g., due to coal or mineral sands mining activities); project infrastructure development; increased river, marine and air traffic; multiple linear corridors maintained for pipeline infrastructure; and nighttime lighting and flaring in a previously low-light landscape, all have the potential to incrementally, yet fundamentally, change the intrinsic character and visual amenity of the landscape surrounding these projects.

The Project on its own is unlikely to significantly change regional landscape character (see Chapter 15); however, the cumulative effects of several resource projects may contribute to a gradual change to its current natural character, which may affect how people perceive and experience the landscape.

17.5.6 Use of Land and Water for Livelihoods

The credible projects identified in Table 17.1 are likely to clear native vegetation and reduce the amount of land available or suitable for growing or hunting food, harvesting building materials, collecting firewood and gathering resources for traditional uses.

The Project will clear approximately 8 ha of forest along approximately 5 km of the onshore export pipeline route that is potentially used for food gardens and planted sago (see Chapter 16).

Forestry activities in PRL-15 and along the onshore export pipeline route between 2000 and 2014 have logged 3,139 ha of hill and alluvial forest (Part 7 of Volume 2). This represents a very low rate of change. The logged forest is being allowed to regrow and continues to be used for livelihood activities, including food gardens.

The clearing footprints of the credible projects outlined in Table 17.1 are unknown; however, given the extent of the licence areas identified in Figure 17.3, large areas of native vegetation

could be cleared in and around PRL-15, and along the Orokolo Bay coastline, with potential adverse implications for community land use and livelihoods (e.g., loss of land available for gardens or collection of wild foods or firewood).

Population increases due to employment opportunities or financial payments related to credible projects could put further pressure on land used to support livelihoods, e.g., around Orokolo Bay, where some resources (e.g., wild plants and timber) are already under pressure due to overharvesting or land use changes. The extent to which the Orokolo Bay Industrial Sands Project will induce in-migration, or whether the timing of any such population increase will overlap with the construction of the Project's onshore export pipeline route shore crossing is unknown.

17.5.7 Community Health and Wellbeing

Chapter 13 outlines the potential for the Project to contribute to an increase in the frequency or severity of diseases such as sexually transmitted infections, malaria and tuberculosis, and to increase the incidence of accidents and injuries. The residual impact significance assessments for most of these health risks are ***Minor*** to ***Moderate***; however, additional projects operating in the PAOI may increase these risks.

Poor sanitation practices and substandard living conditions in areas experiencing growth can lead to an increase in the risk of disease spread and infection rates (Chapter 13). If the credible projects identified as overlapping the PAOI (see Figure 17.3) all commence construction simultaneously, short-term, localized population influx could result; which could increase the frequency, severity and risk of disease (see Section 13.6.2.3).

People earning higher incomes and with increased mobility (i.e., the credible projects' workforces) have a greater chance of participating in high-risk behaviors, which have implications for sexually transmitted infections, including HIV/AIDS, and developing non-communicable diseases associated with an increase in consumables such as alcohol and store-bought foods.

The incidence of accidents and injury could increase due to increased population, river traffic, interactions with construction machinery and vehicles, and potentially a greater incidence of fighting or domestic violence associated with increased alcohol and drug consumption.

Community health may also improve due to investment in infrastructure and services, detailed in Section 17.5.8.

17.5.8 Access to Health and Education Services

Resource developments in Papua New Guinea can place additional pressure on health care and education infrastructure and services; however, an overall improvement in the services can occur if resource developments or local/provincial governments invest in these services.

Adverse effects from increased pressure on these systems could include:

- An increase in untreated diseases and injuries.
- A reduction in school enrolment and attendance.
- A shortage of teachers and/or healthcare workers.
- A decrease in literacy rates.

Positive effects could include:

- Improved health outcomes such as lower disease rates and improved health education.
- Improvements to school attendance, literacy, training and workforce skills.

The projects identified in Table 17.1 are unlikely to place additional pressure on the health and education services in the PAOI. The Mayur Resources projects are small-scale mining operations that are unlikely to require large workforces, and the other credible projects are outside of Gulf Province and are unlikely to impact on health or education services in the PAOI. If the credible projects identified as overlapping the PAOI (see Figure 17.3) all commence construction simultaneously, short-term, localized population influx could result; however, given the geographic spread of these projects, this is unlikely to result in a significant impact to Community access to health and education services.

Collectively, multiple resource projects may improve national workforce skills and work experience, and improve literacy and education levels, providing project benefits paid to local-level or provincial governments are invested in these services. Multiple projects operating in the region could also lead to improved training and skills development through on-the-job training, vocational courses and the stimulus to local training providers of increased demand.

17.5.9 Drinking Water

The main sources of drinking water for PAOI communities is from rainwater containers (37% of households), tanks (32% of households), rivers and creeks (16% of households) and shallow wells (8% of households). Rainwater is untreated, and longevity depends on the rate of consumption and the quantity stored for each family.

Many people in the PAOI extract water from the Purari River or its tributaries for drinking and cooking. The extent to which the Purari River is relied upon depends on the availability of and distance to better water sources. There is a greater dependency on the Purari River as a water source during extended dry periods, when alternative sources may not be available. Many communities in Orokolo Bay rely on wells in shallow groundwater, which overlies more saline groundwater.

The Project is unlikely to significantly affect fresh surface or groundwater supplies for domestic use in the PAOI (see Chapter 16); however, multiple projects operating upstream of communities that use the Purari River for drinking water could contribute to a deterioration of water quality. This could occur through discharge of wastewater or accidental releases of contaminants; however, it would depend on when and where in the catchment the releases occur, and the assimilative capacity of the Purari River. Any impacts on water quality could have subsequent impacts on food security, health and nutrition, as villagers may choose to avoid washing sago or fishing in the Purari River and spend greater time and effort sourcing alternative supplies.

Similarly, developments along the Orokolo Bay coastline (i.e., the Papua LNG Project, Mayur Resources mineral sands project) could result in a cumulative decrease in groundwater quantity or quality, which could reduce community health, particularly given the groundwater wells are readily susceptible to microbiological contamination.

17.5.10 Traditional Practices and Language

PAOI communities maintain intangible cultural heritage values, such as the local language, oral traditions, oral histories, ritual practices, traditional knowledge about medicines and knowledge of the physical world related to subsistence activities. Chapter 14 identifies potential Project-related impacts to intangible heritage, including a decline in inter-generational knowledge transfer, reduced use and knowledge of traditional sites and practices, and a decline in use of local languages.

These impacts are likely to become more wide-reaching and inherent, as the traditional subsistence economy shifts to adopt the opportunities associated with resource development.

More people are likely to spend less time working the land and to have greater access to modern health services and store-bought products, which may improve nutrition and health outcomes. Conversely, an erosion of subsistence-based and traditional knowledge may lessen food security when economic circumstances change, e.g., when employment opportunities decline after construction and after Project decommissioning.

17.5.11 Economic Security

Resource projects contribute significantly to the PNG national economy, and multiple resource projects in operation simultaneously could generate considerable income for the national, provincial and local-level governments, and for local communities. The development of one or more additional resource projects could also increase income levels in the PAOI, depending on the location, size, duration and benefit-sharing arrangements for each project.

Resource projects bring local employment, business opportunities and diversification of the predominantly subsistence-based economy. The existing logging industry and the proposed Mayur Resources developments in Gulf Province have, or are projected to have small workforces, unlikely to contribute significantly to economic development. The Project's construction and operations are likely to be the primary stimulus for local business opportunities through increasing demand for goods and services, such as food, accommodation, transportation and consumables. Although not yet in operation, the Project has already provided a source of local employment and associated services, particularly among Pawaia villages (in PRL-15), during its exploration and development stages.

An adverse impact of multiple resource projects operating simultaneously is that subsistence labor requirements for women and children may increase, as men seek employment with different projects, and increase economic vulnerability. Conversely, a positive impact can include women being provided with more training, education and business opportunities, increasing their employment potential.

Multiple projects are likely to contribute positively to improvements to economic infrastructure, which is currently very poor in the PAOI. This may include improvements to communications, transport and electrical infrastructure.

17.5.12 Commercial Marine Traffic

The P'nyang project could generate several hundred return barge trips over its construction period, using the Port Moresby to Kiunga shipping route (Route 2, Figure 10.7).

The Project will use the Port Moresby to Purari River route (Route 6, Figure 10.7). This route could also be used by Mayur Resources' Depot Creek Coal Project and Orokolo Bay Industrial Sands Project, which would increase barge traffic along these nearshore shipping lanes.

A cumulative increase in nearshore shipping increases the risk of marine accidents and/or accidental release of contaminants (discussed further in Chapters 12, 15 and 18). Chapter 15 identifies the Project's contribution to commercial marine traffic as negligible, given the low existing use of the shipping routes, (except for the area approaching the port of Port Moresby), and the short time (approximately five years) that most of the increase in shipping would occur. Given the lack of publicly-accessible information on the credible projects listed in Table 17.1, it is difficult to predict any potential cumulative increase in marine traffic; however, given the low use of nearshore routes, any increase is unlikely to significantly impact other route users or the environment, providing all parties operate under standard communications and safety procedures.

17.5.13 Airport Capacity

The international airport in Port Moresby will experience an increase in demand for flights in and out of the capital to support the Project's peak construction workforce estimated to be up to 6,000 people. Other credible projects, if they occur at the same time, are likely to require their workforce to fly through Port Morseby to regional airstrips/airports. This combined increase in demand could exert pressure on airport infrastructure and capacity, potentially affecting other users.

17.6 Proposed Mitigation and Management Measures

Step 5 of the cumulative impact assessment process (see Figure 17.1) involves the design of mitigation measures to treat the potential cumulative impacts to key values.

TEP PNG will manage the contribution of its activities to cumulative impacts by implementing the mitigation measures, monitoring and management plans outlined in Chapters 11 to 16. TEP PNG will also work with national, provincial and local-level government authorities and other resource companies and government agencies to help identify strategies to manage potential cumulative impacts. This may include participation in joint planning initiatives with relevant stakeholders, and sharing best practices and lessons learnt from the implementation of mitigation measures addressing environmental and socio-economic impacts due to each project. Where feasible, other developers could be invited to invest expertise or resources in the joint implementation of initiatives addressing cumulative impacts.

17.7 Conclusion

Papua New Guinea is a developing country that is endowed with natural resources. Multiple projects are in various stages of planning, exploration and operation to develop these resources consistent with the PNG's national goals and directive principles.

This cumulative impact assessment identified six potential impacting processes from six credible projects that could potentially impact identified key values. Some of these projects (i.e., the P'nyang Project, the PNG LNG Facility at Caution Bay and the Project) are inter-related and inter-dependent, relying on transportation and processing facilities operated by partner companies.

The Project's contribution to the potential cumulative impacts is predicted to be minor relative to the credible projects listed, recognizing that little publicly available information exists to support a detailed assessment.

The assessment does highlight the following key areas that require PNG Government-led strategies to address the potential cumulative impacts:

- Management of overlapping licence areas and multiple resource extraction activities occurring in PRL-15 and along the Orokolo Bay onshore export pipeline shore crossing.
- Management of potentially significant impacts on sensitive species, ecosystems and community land use/livelihoods due to land clearing.
- Improvements to economic infrastructure in Gulf Province, and support for business and employment diversification to reduce long-term economic reliance on resource projects.

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