

Papua LNG Project Upstream ESHIA Synthesis

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Abbreviations

Abbreviation	Definition
AES	Avenell Engineering Systems
AF	Associated Facility/Facilities
AGR	Acid Gas Re-injection
AGRU	Acid Gas Removal Unit
AIDS	Acquired Immune Deficiency Syndrome
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
ANC	Acid Neutralising Capacity
ANT	Antelope (Gas Field)
ANZFA	Australian and New Zealand Food Authority

Abbreviation	Definition
ANZG	Australian and New Zealand Guidelines
AoA	Analysis of Alternatives
APDL	Application for Petroleum Development Licence
APL	Application for Pipeline Licence
APPFL	Application for Petroleum Processing Facility Licence
APS	Announced Pledges Scenario
AQ	Air Quality
AQIA	Air Quality Impact Assessment
ARGOSS	The metocean consulting division of BMT
ARI	Average Reoccurrence Interval

Abbreviation	Definition
ASL	Above Sea Level
ASS	Acid Sulphate Soils / Acid Sulfate Soils
AusRivAS	Australian Rivers Assessment System
BES	Biodiversity Ecosystem Services
BESAP	Biodiversity and Ecosystem Services Action plan
BESS	Biodiversity and Ecosystem Services Strategy
BMT	British Maritime Technology (company)
BoM	Australian Bureau of Meteorology
BSA	Benefit Sharing Agreement
BSE	Biodiversity, Social, Environment
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
BTEXN	Benzene, Toluene, Ethylbenzene, Xylenes + Naphthalene
BVG	Broad Vegetation Group
CALM Buoy	Catenary Anchor Leg Mooring Buoy
CCRA	Climate Change Risk Assessment
CEPA	Conservation & Environment Protection Authority
CESMP	Construction Environment and Social Management Plan
CH	Critical Habitat or Cultural Heritage (<i>context dependent</i>)
CHA	Critical Habitat Assessment
CHMP	Cultural Heritage Management Plan
CH PCS	Cultural Heritage Pre-Clearance Surveys
CHS	Community Health & Safety
CHSS	Community Health, Safety & Security
CHSSMP	Community Health, Safety and Security Management Plan
CIA	Cumulative Impact Assessment
CLO	Community Liaison Officer

Abbreviation	Definition
CLUCA	Clan Land Use Consent Agreements
CMWMA	Crater Mountain Wildlife Management Area
CNHA	Critical and Natural Habitat Assessment
CO	Carbon Monoxide
COF	Construction Offloading Facility
CO ₂	Carbon Dioxide
COVID	Corona Virus Disease caused by SARS- CoV-2 virus
CPF	Central Processing Facility
CR	Critically Endangered
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSO	Civil Society Organisations
CSRA	Community Security Risk Assessment
CulHA	Cultural Heritage Assessment
D&B ESIA	Dredging & Barging Impact Assessment
DD	Due Diligence
DD ₁	Data Deficient
DHI	Danish Hydraulic Institute
DMP	Dredging Management Procedure
DSP	Delta Swamps and Plains
DNV	Det Norske Veritas
DRA	Detailed Risk Assessment
EA	Earth Active
EAAA	Ecologically Appropriate Assessment Area
EAR	Environmental Assessment Report
EBS	Environmental Baseline Survey
ECA	Export Credit Agency
ECO-SSLs	Ecological Soil Screening Level
EGR	Enhanced Gas Recovery
EHS	Environment, Health and Safety

Abbreviation	Definition
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ELK	Elk (gas field)
EMPNGA	ExxonMobil PNG Antelope Limited
EN	Endangered
ENSO	El Niño–Southern Oscillation
EP	Equator Principles
EPA	Environmental Protection Agency
EPC	Engineering, Procurement and Construction
ERA	Environmental Risk Assessment
ERP	Emergency Response Plan
E&S	Environmental & Social
ESA	Ecosystem Services Assessment
ESBS	Environmental and Social Baseline Studies
ESDD	Environmental and Social Due Diligence
ESHIA	Environmental, Social and Health Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
EW&I	Early Works & Infrastructure
FAO	United Nations Food and Agricultural Organization
FEED	Front-End Engineering Design
FGD	Focus Group Discussions
FID	Final Investment Decision
FIMS	Forest Information Management System
FOC	Fibre Optic Cable
FPIC	Free, Prior and Informed Consent

Abbreviation	Definition
FSC	Forest Stewardship Council
FSO	Floating Storage and Offloading
GBV	Gender-Based Violence
GELs	Guideline Exposure Levels
GHD	Global consulting company - GHD Pty Ltd
GHG	Greenhouse Gas
GIIP	Good International Industry Practice
GIS	Geographic Information System
GOPPF	Gulf of Papua Prawn Fishery
GPHA	Gulf Provincial Health Authority
GPS	Global Positioning System
GSF	Government Security Forces
H ₂ S	Hydrogen sulfide
HAZAN	Hazard Analysis
HAZID	Hazard Identification
HAZOP	Hazard and Operability Studies
HB	Herd Base
HDD	Horizontal Directional Drilling
HEPA	Heads of Environmental Protection Agency Australia and New Zealand
HIV	Human Immunodeficiency Virus
HRIA	Human Rights Impact Assessment
HRDD	Human Rights Due Diligence
HSE	Health, Safety and Environment
HSS	Health, Safety and Security
HSSSE	Health, Safety, Security, Social and Environment
HSU	Hydro-Stratigraphic Units
IAQM	Institute of Air Quality Management
ICP	Informed Consultation and Participation
IDP	Internally Displaced Person
IEA	International Energy Agency

Abbreviation	Definition
IEMA	Institute of Environmental Management and Assessment
IESC	Independent Environmental and Social Consultant
IFC	International Finance Corporation
ILG	Incorporated Land Group
ILO	International Labour Organization
IMO	International Maritime Organization
IOGP	International Association of Oil & Gas Producers
IP	Indigenous Peoples
IPCA	In-Principle Compensation Agreements
IPCC	Intergovernmental Panel on Climate Change
IPIECA	International Petroleum Industry Environmental Conservation Association
IPF	Indigenous Peoples Framework
IPO	Interdecadal Pacific Oscillation
IPR	Indigenous Peoples Representative(s)
IR	Incident Reporting
IRPA	Individual Risk per Annum
ISA	Invasive Species Assessment
ISEZ	Industrial Special Economic Zone
IUCN	International Union for the Conservation of Nature and Natural Resources
JET	Jet Fuel (Jet A-1)
JV	Joint Venture
KBA	Key Biodiversity Area
KII	Key Informant Interviews
KPI	Key Performance Indicator
KPS	Kutubu Pipeline System
LALDP	Land Access and Livelihood Development Plans (North and South)

Abbreviation	Definition
LALF	Land Access and Livelihoods Framework
LAT	Lowest Astronomical Tide
LC	Least Concern
LCT	Landing Craft Tank
LGBTQIA	Lesbian, Gay, Bisexual, Transgender, Queer/Questioning, Intersex, Asexual
LI	Landscape Institute
LiDAR	Light Detection and Ranging
LLG	Local Level Government
LNG	Liquefied Natural Gas
LoRs	Limits of Reporting
LRP	Livelihood Restoration Plan
LT	Low-Temperature
LWC	Labour and Working Conditions
MARPOL	International Convention for the Prevention of Pollution from Ships
MLs	Maximum Levels
MOF	Module Offloading Facility
MoU	Memorandum of Understanding
MP	Management Plan
MPH	Middle Purari Hills
MRU	Mercury Recovery Unit
MT	Metric Tonne
NDC	Nationally Determined Contribution
NE	Not Evaluated
NEPM	National Environment Protection Measure
NEMP	National Environmental Management Plan
NFA	National Fisheries Authority
NGO	Non-Governmental Organisation
NGFS	Net Gain Feasibility Study
NH	Natural Habitat

Abbreviation	Definition
NLB	New Logistics Base
NMAG	National Museum and Art Gallery
NMSA	National Maritime Safety Authority
NO	Nitric Oxide
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxides
NT	Near Threatened
NTU	Nephelometric Turbidity Unit
NVS	National Volunteer Service
NW	North West
NZE	Net Zero Emissions
OBM	Oil-Based Mud
OECD	Organization for Economic Cooperation and Development
OGC	On-Site Grievance Committee
OHS	Occupational Health and Safety
OIMS	Operations Integrity Management System
OS	Operating Scenario
OSCAR	Oil Spill Contingency and Response modelling tool
OSGC	On-site Grievance Committee
P&IDs	Piping and Instrumentation Diagrams
PA	Protected Area
PAP	Project-affected Persons
PACs	Project-affected Communities
PAH	Polycyclic Aromatic Hydrocarbons
PAoI	Project Area of Influence
PARC	Protected Area Register / Classification
PASS	Potential Acid Sulphate Soil
PCCSP	Pacific Climate Change Science Program
PCS	Pre-Clearance Survey
PDL	Petroleum Development Licence

Abbreviation	Definition
PDO	Pacific Decadal Oscillation
PER	Pipeline Export Route
PGT	Power Gas Turbine
PHSE	Public Health, Safety and Environment
PID	Photoionization Detectors
PLC	Pacific Lime and Cement Limited
PIIM	Project Induced In-Migration
PLEM	Pipeline End Manifold
PLNG	Papua Liquefied Natural Gas
PM ₁₀	Particulate Matter ≤10 micrometres (µm) in diameter
PM ₂	Particulate Matter ≤2.5 micrometres (µm)
PNG	Papua New Guinea
PNGNSC	Papua New Guinea National Standards Council
PPE	Personal Protective Equipment
PPT	Parts Per Thousand
PRI	Purari (River / Delta) Location Code
PRL	Petroleum Retention Licence
PS	IFC Performance Standard
PTW	Permit to Work
QA	Quality Assurance
QRA	Quantitative Risk Assessment
RAP	Resettlement Action Plan
RCP2	Representative Concentration Pathways 2
RCP8	Representative Concentration Pathways 8
RIA	Residual Impact Assessment
RINA	Registro Italiano Navale
RMMP	Raw Materials Management Plan
ROV	Remotely Operated Vehicle
RoW	Right-of-Way

Abbreviation	Definition
RPNGC	Royal Papua New Guinea Constabulary
RRM	Risk Reduction Measures
RTMP	Road Traffic Management Plan
SABL	Special Agriculture and Business Lease
SAF	Safety
SARV	Sorcery-Accusation-Related Violence
SC	Southeast Coast
SDV	Shutdown Valves
SE	Stakeholder Engagement
SEA	Strategic Environmental Assessment
SEAH	Sexual Exploitation, Abuse and Harassment
SEMP	Stakeholder and Environmental Management Plan
SENVID	Social and Environmental Impact Identification
SEP	Stakeholder Engagement Plan
SH	Southeast Hills
SIA	Social Impact Assessment
SIMOPS	Simultaneous Operations
SME	Small and Medium Enterprise
SMLI	Social Mapping and Landowner Identification
SMP	Soil Management Plan
SMS	Short Message Service
SO ₂	Sulphur Dioxide
SOLAS	International Convention for the Safety of Life at Sea
SOP	Standard Operating Procedures
SO _x	Sulphur Oxides
SSC	Social Steering Committee
SSIV	Subsea Isolation Valve

Abbreviation	Definition
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
STI	Sexually Transmitted Infection
SWL	Sound Power Level
TB	Tuberculosis
TCEQ	Texas Commission on Environmental Quality
TCF	Temporary Construction Facility
TCFD	Task Force on Climate-related Financial Disclosures
TCHNA	Terrestrial Critical Habitat and Natural Habitat Assessment
TEP	TotalEnergies
TEP PNG	TotalEnergies EP PNG Limited
TIC	Total Inorganic Carbon
TOC	Total Organic Carbon
TP	Tie-in Point
TPH	Total Petroleum Hydrocarbons
TRA	Technical Risk Assessment
TRH	Total Recoverable Hydrocarbons
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
TUFLOW	Two-Dimensional Unsteady FLOW (hydrodynamic modelling software)
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
USDA	United States Department of Agriculture
USFDA	United States Food and Drug Administration
UXO	Unexploded Ordnances
VCA	Village Community/Cultural Atlas
VEC	Valued Ecosystem Component

Abbreviation	Definition
VLO	Village Liaison Officer
VOC	Volatile Organic Compound(s)
VPSHR	Voluntary Principles on Security and Human Rights
VU	Vulnerable
WASH	Water, Sanitation & Hygiene
WBG	World Bank Group
WHO	World Health Organization
WMA	Wildlife Management Area
WMC	Waste Management Centre
WMF	Waste Manifest Forms
WMP	Waste Management Plan
WRF	Weather Research and Forecasting

Executive Summary

This Environmental, Social and Health Impact Assessment (ESHIA) Synthesis has been prepared on behalf of TotalEnergies EP PNG Limited (TEP PNG), as the operator of the upstream and midstream components of the proposed Papua Liquefied Natural Gas (LNG) Project, located in Papua New Guinea (PNG). It covers the upstream and midstream components only (collectively, Upstream Components) that are hereafter referred to as the “Papua LNG Project” or the “Project”.

This Synthesis is desktop-based and consolidates the Project’s environmental and social (E&S) assessments. It draws on the extensive body of Project documentation produced since the Upstream Environmental Impact Statement (2019), hereafter referred to as EIS (2019), including the:

- Upstream EIS PRL-15 Addendum: Main Report & Appendices (2024), hereafter referred to as EIS Addendum (2024).
- FEED Changes Environmental Assessment Report (2025), hereafter referred to as FEED Changes EAR (2025); and
- Specialist topic studies.

Impact identification and significance evaluation aim to align with PNG regulatory requirements and international standards, including the International Finance Corporation (IFC) Performance Standards (PS), Equator Principles (EP), and OECD Common Approaches.

This executive summary highlights the key E&S topics assessed throughout this ESHIA Synthesis.

Site Location and Project Overview

The assessment confirms that the Project is located within a remote, environmentally and socially sensitive context characterised by customary land tenure, high dependence on land, riverine and marine resources, and the presence of Indigenous Peoples (IP) with strong cultural and livelihood connections to the Project Area of Influence (PAoI).

The Project consists of three wellpads within the Elk and Antelope gas fields. Two of these wellpads (ANT-10 and ELK-10) will produce reservoir fluids. The third (ANT-11) will be used as an injection wellpad for the reinjection of water and acid gas. Reservoir fluids will be transported from ELK-10 to ANT-10 via two 14” diameter buried pipelines and then transported south from ANT-10 via two 22” diameter buried pipelines (approximately 10 and 30 km long respectively) to a Central Processing Facility (CPF) located 120 m inland from the north-western bank of the Purari River.

The CPF will require vegetation clearance and earthworks. It will comprise of processing units, utilities, condensate storage, flares and vents, and marine offloading facilities. At the CPF, reservoir fluids will be separated into gas, condensate, water and acid gas, with water and acid gas transported north via dedicated pipelines (approximately 30 km) to the ANT-11 wellpad, where reinjection in the reservoirs will take place. Two export pipelines will transport gas and condensate south to Orokolo Bay on the Gulf of Papua coastline. Once offshore, the subsea and condensate pipelines diverge. Gas will be transported southeast approximately 260 km to the existing PNG LNG plant in Caution Bay, where the gas will be treated and liquified to commercial LNG specifications. The condensate pipeline will transport condensate southwest approximately 90 km to a third party operated Floating Storage and Offloading (FSO) unit.

Supporting infrastructure includes approximately 43 km of private roads, expanded facilities at Herd Base, quarries, borrow pits, spoil sites, the upgraded Purari Airstrip, temporary camps, helipads, waste management areas and river dredging (approximately 2 million m³) for navigation.

The design life for the Project is 30 years, 5 years of construction and 25 years of operations. The facilities will also undergo a decommissioning phase post this 30-year Project life.

Construction logistics will rely heavily on marine, river, road, and air transport, with over 85,500 personnel movements forecast during the five-year construction period. Workforce numbers will peak at approximately 6,000 (incl. both onshore and offshore personnel) during construction, reducing to approximately 250-300 during operations. Multiple temporary construction camps, and a long-term operations camp at Herd Base will accommodate workers.

The Project has been designed to minimise its disturbance footprint as far as practicable by limiting the extent and duration of land take and, where possible, utilising previously disturbed areas. The total Project disturbance footprint, across onshore and offshore components, is approximately 2,453 ha. Of this, the EIS Addendum (2024) estimates that approximately 190 ha will be located on previously disturbed land, thereby avoiding new impacts on undisturbed areas. In addition, around 1,280 ha of the Project footprint will be temporary, with these areas planned to be rehabilitated and restored post-construction, primarily through natural regeneration, to further minimise long-term residual impacts. See Section 3, Table 3-3, for a further breakdown of the different Project components.

The Project's Area of Influence (PAoI) is presented in Figure 0-1 below.

Summary of Key Findings

The Synthesis identifies a range of E&S risks, the majority of which are associated with construction phase activities and are localised in nature. These risks occur within a remote, predominantly Indigenous context with high dependence on customary land and natural resources. Key environmental risks are driven by construction activities, with additional considerations during operations related to greenhouse gases (GHG), biodiversity, water resources and cumulative effects. Social risks relate to land access and livelihood disruption, community health and safety (particularly along transport, dredging and barging corridors), Indigenous rights, the requirement for Informed Consultation and Participation (ICP) and Free, Prior and Informed Consent (FPIC) processes, labour and working conditions, and the management of stakeholder expectations in a long-duration, multi-phase development.

The Project has an existing Environment and Social Management System (ESMS) that provides the overarching framework for systematically identifying, assessing, and managing health, safety, security, E&S risks, throughout the Project life-cycle and PAoI. The ESMS builds on the commitments register established in the EIS (2019) and incorporates additional commitments introduced within the EIS Addendum (2024), FEED Changes EAR (2025), Purari River Dredging and Barging Impact Assessment hereafter referred to as D&B ESIA (2025), and Hou Creek Aggregate Dredging Environmental Assessment Report, 2025, hereafter referred to as Hou Creek Aggregate Dredging EAR (2025), to reflect Project design updates.

Across E&S topics, avoidance and minimisation have been incorporated into Project design where practicable, with residual risks addressed through targeted management measures. Impacts persist where values are irreplaceable, receptors highly sensitive, or Project footprints permanently alter land, water, or cultural systems.

Overall, the predicted E&S impacts, will be predominantly associated with the construction phase, are anticipated to remain localised, and are considered manageable through the Project's planned mitigation measures and ESMS. Successful delivery will depend on continued engagement with communities (ICP) and FPIC processes, effective land and resource access processes, long-term biodiversity offset programmes, and ongoing monitoring and adaptive management throughout the Project lifecycle.

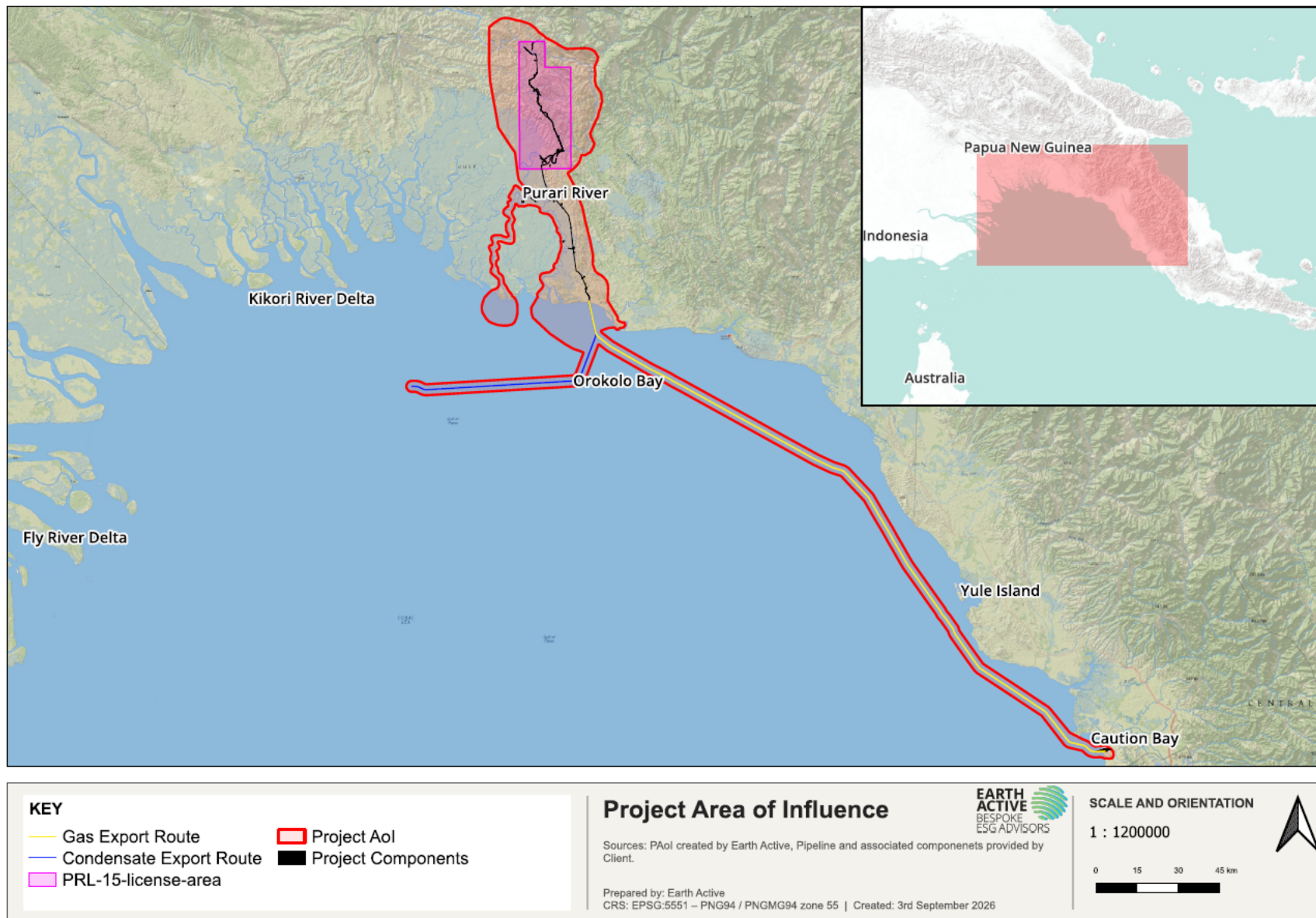


Figure 0-1: Updated Project Area of Influence (Source: Earth Active, 2026)

Key Environmental Risks and Impacts

Environmental risks associated with the Project are primarily driven by construction activities across a remote and environmentally sensitive landscape that includes intact terrestrial forests, freshwater and estuarine systems, and diverse marine habitats. Key material environmental risks relate to habitat loss and fragmentation, sedimentation and water-quality changes, underwater and terrestrial noise, waste generation, increased riverine and marine traffic, and potential introduction or spread of invasive species.

The Project's environmental residual impacts are predominantly Minor to Moderate following the application of the mitigation hierarchy, FEED optimisation, and topic-specific management plans. Moderate residual impacts remain associated with permanent vegetation loss and fragmentation in Critical Habitat-qualifying forest habitat, geomorphological change and sedimentation in freshwater systems, and localised permanent loss of marine and riverine habitat where infrastructure, aggregate dredging, and vessel traffic are required. In the Purari River system, aggregate dredging and increased vessel movements may result in changes to riverbed and sandbank morphology, increased suspended sediments, and localised disruption to aquatic habitats and ecosystem services, despite avoidance and control measures. Disturbance to fauna and focal breeding and roosting sites may occur through noise, vibration and light emissions. These environmental impacts are managed through a combination of route and site selection to avoid the most sensitive areas, engineered sediment and erosion controls, dredging management and monitoring, progressive rehabilitation, biodiversity offsets where required, and adaptive management. Although some impacts linked to permanent infrastructure and high-sensitivity environments cannot be fully eliminated, they can be reduced to acceptable residual levels under international standards.

Overall, with the ESMS and environmental management plans in place, environmental risks are considered localised, manageable, and predominantly low in residual significance, subject to continued monitoring, adaptive management, and compliance with IFC PS requirements.

Major Hazards and Process Safety

Major hazards are associated with very low likelihood accidental, upset or abnormal events. Although, the likelihood of major accidents is low, the fact that these can result in high consequences, such as multiple fatalities, means that major hazards and the risk of these must be managed accordingly. Key hazards including fires, explosions, toxic gas release, seismic damage, and fuel spills have been identified through detailed risk assessments, with mitigations reducing risks to As Low as Reasonably Practicable (ALARP). Facilities incorporate safety-by-design features such as fire zone segregation, blast-resistant structures, monitored buried pipelines, advanced detection systems, shutdown protocols, and defined evacuation routes. Emergency preparedness is provided through an Affiliate Emergency Response Plan, hereafter referred to as Affiliate ERP, Oil Spill Contingency Plan (OSCP) and Blowout Contingency Plan (BOCP), with regular drills, community communication, and development of a community-specific ERP (which will either be a standalone document or integrated into the ERP described immediately above). Residual risks will be managed through ongoing safety systems, periodic risk reduction workshops, and updates to emergency and spill response plans.

Greenhouse Gases (GHG)

Scope 1 and 2 emissions have been incorporated in the Climate Change Risk Assessment Synthesis Report, 2025, hereafter referred to as CCRA Synthesis Report (2025). Scope 1 emissions are comprehensively defined across Project infrastructure and activities whilst Scope 2 emissions are negligible due to self-generation of power. Construction emissions are dominated by land-clearing carbon stock loss (equivalent of less than 2% of lifetime Scope 1 emissions over the Project time), while operational phase emissions are driven by power generation, flaring/venting, and transport, partially offset by long-term acid gas reinjection (approximately 18,000 kt CO_{2e}). Operational emissions peak mid-life and decline with reduced LNG production. Mitigation

measures include no routine flaring, energy efficiency, acid gas reinjection and operational controls that are embedded in design and management plans.

Air Quality

Ambient air quality is good, with few nearby sensitive receptors and negligible background pollutant levels. The closest sensitive receptor is identified as Pokore Hamlet. Modelling for normal operations and flaring scenarios shows predicted concentrations of key pollutants (NO₂, SO₂, CO, PM_{2.5} and PM₁₀) are well below international guidelines. Construction impacts are low for health and dust nuisance, with medium short-term ecological effects during earthworks that are expected to recover quickly; operational emissions remain within criteria. Mitigation includes stack design, flaring limits, acid gas reinjection, dust control, equipment maintenance, low-sulphur fuel use, and emissions monitoring.

Climate Change and Climate Risk

The Project's most material current physical risks relate to baseline climate hazards, including flooding, rainfall-induced landslides, extreme heat, and coastal processes. These risks are particularly relevant due to reliance on linear infrastructure (roads, pipelines, barging), where access disruption and logistics impacts remain credible. Overall vulnerability under present-day conditions is generally low to medium due to high adaptive capacity.

Future climate change is expected to exacerbate these existing hazards, increasing their intensity, frequency, and/or likelihood over time. As a result, risks associated with flooding, extreme rainfall, and heat stress may become more significant, particularly beyond 2030 under higher emissions scenarios.

Mitigation includes acid gas reinjection, climate-resilient design, drainage and erosion control, cooling systems, corrosion protection, proactive maintenance, and market risk strategies.

Transition risks are also expected to increase over time, especially beyond 2030 under faster decarbonisation pathways, with market and reputational risks becoming more prominent. While many risks can be mitigated through engineering design, operational controls, contractual structures, and lower-carbon technologies (e.g. CO₂ sequestration, hydrogen-ready power), long-term resilience will depend on proactive adaptation and evolving market strategy.

Noise and Vibration

Baseline monitoring indicates ambient noise is primarily from natural sources and village activities, with limited existing industrial noise. Modelling shows construction and normal operations will generally meet Project noise criteria, with exceedances during infrequent abnormal conditions such as flaring. Underwater noise from piling, dredging, vessel traffic, and offshore works may exceed disturbance thresholds for some aquatic fauna.

Application of the Project's Noise & Vibration Management Plan and associated controls will support mitigation of Project impacts. Residual effects during CPF construction and operations are expected to be Minor to Moderate. Localised Moderate residual noise impacts are anticipated at Pokore Hamlet, particularly at night or during abnormal flaring events, due to its proximity. These are limited to specific activities and weather enhanced propagation, and would be managed through scheduling, equipment controls, and community notification. Further noise assessments will be undertaken during detailed engineering. Other components such as pipeline shore crossing, dredging and Horizontal Directional Drilling (HDD) produce Negligible or Minor residual terrestrial noise due to distance and very small exceedances (≤2 dBA).

Given the short duration, spatially limited nature of construction noise sources, and the mitigation and monitoring framework in place, residual underwater noise impacts are assessed as Minor, temporary, and not significant for riverine and marine fauna populations. Underwater vibration effects are closely linked to

underwater noise and are expected to be generally confined to short-term, localised disturbance in the immediate vicinity of active works.

Mitigation includes design controls, restricted work hours, community notification, noise suppression devices, soft-start piling, marine fauna observation protocols, and compliance monitoring.

Vibration impacts associated with construction, dredging, pipeline installation, and vessel movements are expected to be localised, low-energy, and short-term, with residual impacts assessed as Minor to Negligible for all onshore receptors following mitigation. Baseline vibration levels are very low in the PAoI, there are no vibration-sensitive structures, and vibration attenuates rapidly with distance; no significant effects to communities, buildings, or heritage assets from vibration are anticipated, with management provided through standard construction controls and monitoring.

Soils and Geology

The Project area features ridge and ravine terrain, alluvial plains, and coastal lowlands, with poorly developed soils and high acid sulphate potential in low lying areas. Geohazards include erosion and landslides in steep or weak strata but these risks have been considered in facilities design, and the CPF site is considered generally stable. Construction will disturb soils, posing risks of erosion, acid sulphate oxidation, and accidental contamination. Mitigation includes progressive rehabilitation, erosion controls, Potential Acid Sulphate Soil (PASS) management, and spill prevention and contingency measures. Residual impacts to soil and geology are assessed predominantly as Negligible to Minor. Moderate residual impacts are confined to slope instability (landslide/mass movement) in ridge/ravine landforms and at Elk-2 borrow pit and associated trunklines/roads. Most other soil risks, such as local erosion at specific borrow pits, sandy soil destabilisation, PASS oxidation/disturbance, facility cut-and-fill instability, and HDD-related disturbance at the shore crossing, are assessed as Negligible.

Hydrology, Hydrogeology and Water Resources

The lower Purari River catchment has high flows, elevated turbidity, low nutrients/metals, and some sediment and soils with high acid sulphate potential. Project works may cause localised changes to hydrology, sediment transport, and water quality, with minor effects from dredging, vessel traffic, and crossings; a trenchless method will be used for the Purari River pipeline crossing. Shallow groundwater used by villagers and sourced from local village wells generally meets chemical standards for drinking water. Historical observations of shallow groundwater quality have indicated the presence of elevated levels of microbiological indicators/pathogens that are unrelated to Project activities. Shallow groundwater sources at inland and coastal villages along the pipeline export route (PER) have been found to be vulnerable to drawdown as a result of pipeline trenching. Potential contamination to shallow groundwater sources at coastal and inland villages and the CPF site has also been identified as a result of accidental spills or due to waste leachates. Mitigation will include erosion controls, progressive rehabilitation, PASS management, low-impact pipeline river crossing methods, water extraction limits, and spill prevention. Residual impacts are expected to be mostly Negligible to Minor. Activities along the Purari River and at Hou Creek associated with aggregate dredging, and the potential for accidental hydrocarbon spills, retain Moderate residual impacts, particularly related to water quality deterioration and geomorphological disturbance, although these remain spatially limited and manageable. Potential soil erosion due to ground disturbance at CPF P3 site, causing increased TSS, turbidity and sedimentation of defined waterways, also retains a Moderate residual impact.

Resources and Waste Management

The Project's resource needs primarily focus on construction aggregates, with an estimated 2.7 MT sourced from quarries, borrow pits and dredging upstream and downstream of Hou Creek in the Purari River. Key potential impacts include vegetation loss, soil and habitat disturbance, hydrology and water-quality changes,

dust, noise, vibration, waste generation, invasive species risks and short-term community effects. Mitigation measures such as phased clearing, erosion controls, spill prevention, ecological surveys, weed and pest management, and dust/noise suppression are expected to reduce most residual impacts to Negligible or Minor levels. The main remaining concern is a Moderate residual impact on surface water quality from accidental hydrocarbon or chemical spills during dredging at Hou Creek.

The construction and operation of the Project will generate large volumes of non-hazardous and hazardous waste, which will require management and disposal. The waste mitigation hierarchy will be implemented, favouring avoidance, reduction, reuse and recycling where practicable. Hazardous waste will be removed from site for management in Port Moresby or overseas if required. A landfill shall be constructed in PRL-15 in accordance with requirements outlined in the Company's general specification for Landfill Design and Operation for E&P Sites (GS EP ENV 421) (Ref. PG-P15-00-PHSE-000032) and will accommodate general non-hazardous waste, with an estimated capacity of approximately 50,000m³. During construction, temporary incinerators may be mobilised to sites to manage (i.e. reduce the volume of) appropriate waste streams. During the latter stages of the early works and throughout operation, a suitably sized, purpose-built, high-temperature, industrial incinerator may be installed. This will be designed according to IFC Environment, Health and Safety (EHS) standards. Long term operational waste will be managed under the Level 3 environmental permit and the Project Waste Management Plan (2024), hereafter referred to as Waste MP (2024) to prevent land, water, and habitat impacts.

Landscape and Visual Amenity

PRL-15 is characterised by dense native vegetation, rugged and flood-prone terrain, low population density, and limited existing development, resulting in few locations with meaningful visual exposure. The closest receptor is Pokore Hamlet, established in 2019 with direct views across the Purari River to the CPF site. A 3D Light Detection and Ranging (LiDAR)-based viewshed analysis (EIS Addendum, 2024) confirms that only a small number of receptors have potential views of Project infrastructure. The CPF flare and hot water stack are the most visually prominent elements, theoretically visible up to 12 km, though actual visibility is substantially reduced by topography and 20 to 40 m canopy cover. With mitigation (vegetation buffers, rehabilitation, controlled lighting, no routine flaring), residual impacts are assessed as being Negligible to Minor for all receptors. Moderate residual visual and lighting impacts may remain at Pokore Hamlet, where consultation and engagement will focus on addressing these issues and monitoring post construction residual impacts.

Marine Physical Environment

Surveys in Orokolo Bay, the offshore pipeline route, and Caution Bay have indicated good marine water quality and good sediment quality. FEED changes have resulted in updated construction methodologies, including the use of HDD at Caution Bay and a reduced cofferdam at Orokolo Bay, which will limit disturbance to coastal processes, turbidity, and sensitive habitats during construction and installation of the pipeline shore crossing. Hydrotest water discharges and vessel effluents will be managed according to applicable MARPOL standards (International Convention for the Prevention of Pollution from Ships). With reduced volumes by reusing hydrotest water and reduced vessel routes; impacts are anticipated to be localised and short-term. Mitigation will include trenchless pipeline shore crossings, optimised design, erosion controls, adaptive trenching management, low-toxicity additives to hydrotest water, and compliance with applicable discharge standards. Residual impacts are expected to be Negligible to Minor.

Traffic and Transportation

Transport activity for the Project is concentrated along the Purari River, a corridor frequently used by communities and highly sensitive due to the absence of practical alternative travel routes. During construction, particularly in the peak period, Project aviation, barging, ferry movements and dredging will

temporarily increase, creating short-term and localised effects such as river-user congestion, navigation and safety risks, wake impacts, access restrictions, and minor disturbance to riverbanks, cultural heritage features, and aquatic fauna. Dredging will also generate temporary turbidity, noise, lighting and erosion risks that require strict management. During operations, vessel movements will reduce to near-baseline levels with minimal interaction with community or commercial users, and decommissioning impacts are expected to be short-lived. With mitigation measures, including vessel-speed and wake controls, daylight navigation, coordinated scheduling, community notifications, cultural-heritage protocols, and MARPOL-compliant waste and discharge controls, residual impacts are expected to remain Negligible to Minor, though community concerns regarding impacts associated with dredging and river safety require ongoing engagement and monitoring.

Biodiversity (Terrestrial, Freshwater, Marine)

The Project area contains intact and highly diverse terrestrial, freshwater, and marine habitats including forests, wetlands, mangroves, coral reefs, and seagrass, supporting numerous Critical Habitat (CH)-qualifying species, including some new-to-science, recorded by Project surveys. Construction activities will cause localised habitat loss and disturbance, increased sedimentation, contamination risks, and potential spread of invasive species, with marine impacts including permanent loss of some reef and mangrove areas and possible disruption of migratory pathways. Mitigation focuses on minimising footprint, avoiding sensitive features, species-specific programmes, invasive species control, discharge and sediment management, vessel speed limits, exclusion zones, and long-term monitoring. Most residual impacts will be Negligible to Minor, although Moderate residual impacts will remain for CH-qualifying forest loss, increased sedimentation in nearby tributaries, and marine habitat losses. Moderate to Major residual impacts remain for a small number of very high sensitivity/rare plant species. A long-term biodiversity offset programme will be required to compensate for residual losses and designed to achieve a measurable net gain for all CH-qualifying biodiversity values.

Long term biodiversity monitoring will allow validating the accuracy of predicted impacts and predicted outcomes of the Project's mitigation measures on biodiversity features. The Project has therefore also developed a Biodiversity Monitoring and Evaluation Plan (BMEP) which outlines the set of monitoring requirements and thresholds to implement adaptive management shall it be required.

Ecosystem Services

Baseline surveys identified a wide range of ecosystem services relied upon by local communities, including food, timber, freshwater, fisheries, erosion control, water purification, cultural values, and habitat provision. Project activities may affect these services through vegetation clearing, reduced access to natural resources, water quality changes, and localised impacts on fisheries, while also offering some potential livelihood benefits. Mitigation measures will include optimising and reducing the construction footprint and associated vegetation clearing, Pre-Clearance Surveys (PCS), water quality protection, sustainable resource initiatives, marine safeguards, vessel controls, and ongoing stakeholder engagement. Residual impacts are Negligible to Minor for all provisioning, regulating, and supporting services. These outcomes are associated with Project construction activities, dredging activities, and riverine/marine transport corridors, although impacts remain localised and manageable with ongoing engagement and monitoring. Activities focused on ecosystem services impacted by the Project are likely to also feature within the Project biodiversity offset programme.

Cumulative and Transboundary Environmental Impacts

PNG is a developing country that is well endowed with natural resources. Multiple major projects are in various stages of planning, exploration and operation to develop these resources consistent with the PNG national goals and directive principles. The EIS Vol. 1 Ch. 17 Cumulative Impacts, 2019, hereafter referred to as EIS Cumulative Impacts (2019) undertaken for the EIS (2019) identified six potential impacting processes

from six credible projects that could potentially impact identified key values. The EIS (2019) notes that some of these projects (i.e., the P'nyang LNG Project, the Exxonmobil 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. Onshore, the Project is located in a landscape of intact, well-connected habitats, with the potential for Project impacts to be exacerbated by the cumulative impacts of other credible projects. The Project's contribution to the potential cumulative impacts is predicted to be Minor relative to the credible projects listed, recognising 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 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.

Key Social Risks and Impacts

Social risks associated with the Project are primarily driven by construction phase activities in a remote, predominantly Indigenous and customary land context, where communities rely heavily on land, riverine and marine resources for their livelihoods, cultural identity and wellbeing. Following application of the mitigation hierarchy, the majority of residual social impacts are assessed as Negligible to Minor, with a limited number of Moderate residual impacts and one Major residual impact remaining. These residual ratings mostly reflect the high sensitivity of affected communities, customary tenure systems and culturally significant locations, rather than deficiencies in Project mitigation.

Residual impacts also persist in relation to Community Health & Safety (CHS), including potential project induced in migration (PIIM) and associated pressures on health services, water and sanitation, and increased risks of gender-based violence and social vulnerability, particularly for women and girls.

Impacts to Indigenous Peoples include ongoing pressure on customary governance structures, social cohesion, and intergenerational transmission of language, cultural knowledge, and traditional practices, driven by employment patterns, income changes, labour influx, and altered access to land and river systems. A Major residual impact to cultural heritage and cultural ecosystem services has been identified at Purivo Junction on the Purari River, where Project-related changes to sandbank morphology intersect with a sacred site of very high cultural sensitivity. No avoidance options were identified by the alternatives analysis. Pre-dredging consultation with affected communities will be undertaken to agree maintenance of access to this site during works. The elevated significance reflects the vulnerability and irreplaceability of the receptor rather than a lack of mitigation.

Livelihood related impacts are predominantly economic displacement, arising from localised and, in some cases, permanent restrictions on access to land, rivers, fisheries, and subsistence resources, with residual impacts assessed as Negligible to Minor following compensation, livelihood restoration planning, and ongoing engagement. Social impact management is therefore centred on avoidance where feasible, sustained FPIC based consultation, implementation of the Cultural Heritage Management Plan (CHMP), targeted community health and safety measures, labour and workforce management, PIIM controls, grievance mechanisms, and adaptive management, recognising that some social impacts associated with permanent infrastructure, demographic change, and highly sensitive cultural receptors cannot be fully eliminated but require long-term, active monitoring and management.

Stakeholder Engagement and Grievance Management

Stakeholder engagement has been undertaken as a continuous, multi-phase process across more than 11 years of Project development, supported by over 13,800 documented engagement records covering upstream, riverine, coastal and peri-urban areas, including government, customary landowners, Indigenous groups and other vulnerable stakeholders. Engagement is delivered through an established Community Relations programme comprising Community Liaison Officers (CLOs), Village Liaison Officers (VLOs), formal community forums, targeted consultations, grievance mechanisms and FPIC/ICP processes, and is closely integrated with land access, livelihood restoration, cultural heritage and impact management activities. The Project operates an established Community Concerns and Grievance Mechanism (CCGM) providing multiple accessible channels for raising and resolving community concerns. Residual risks relate primarily to maintaining stakeholder trust, transparency, meaningful participation and engagement capacity throughout the Project lifecycle, including during peak construction, to ensure effective management of changing Project designs, land access processes, FPIC commitments, grievances and community expectations.

Labour and Working Conditions

The Project will require a large, predominantly temporary construction workforce, peaking at around 6,000 workers, with workforce numbers reducing significantly during operations. Key risks relate to OHS, worker accommodation standards, labour management, and interactions between workers and local communities. The Project has established a labour management framework aligned with IFC PS 2, PNG labour legislation and the Project's Labour and Working Conditions Management Procedure (2025) which is supported by complementary recruitment, grievance, disciplinary, workforce welfare and industrial relations procedures, together with the Project's HSE management system. This framework incorporates measures addressing fair recruitment, worker grievances, codes of conduct, non-discrimination, worker welfare and labour influx management. With these measures in place, residual impacts are assessed as Negligible to Minor, although ongoing management is required to address risks related to workforce influx, gender-based vulnerabilities, fair recruitment, and worker-community interactions.

Community Health and Safety

The main CHS risks arise during the construction phase, driven by sharp increases in road, river, marine, and air traffic, together with dredging and barging activities, communicable disease transmission, and pressure on already-limited health services. Riverine and coastal communities, highly dependent on waterways for transport, livelihoods, cultural practices and access to services, are especially sensitive to these risks. Mitigation measures include comprehensive Community Health, Safety and Security (CHSS) management planning, strengthened emergency response capacity, targeted health awareness programmes, traffic and river-safety controls, and alignment with the Voluntary Principles on Security and Human Rights (VPSHR). With mitigation in place, residual CHS impacts are expected to range from Minor to Moderate. Moderate impacts occurring in specific high-exposure locations during construction and reduce to Minor during operations, though risks associated with PIIM, gender-based violence, and vulnerable groups require ongoing monitoring and sustained engagement throughout the Project lifecycle.

Security

Security risks stem from both existing community security trends and the interaction between security providers (public and private), the workforce, and project-affected communities. In the context of existing vulnerabilities such as limited law and order, land disputes, substance abuse, limited services, pressures from existing in-migration and domestic, gender and sorcery-based violence; the key risks for the Project and communities include the exacerbation of existing trends or emergence of new conflicts, crime or unrest, intimidation or conflict, gender-based violence and harassment. The Project's security framework aligns with IFC PS4 and the VPSHR, including annual security risk assessments, vetting and training of private security

providers, oversight of Government Security Forces (GSF) operating under an MoU, community-focused security engagement, grievance pathways, and integration of human rights expectations into contractor management. Residual security impacts were assessed as part of the EIS (2019). The Project has a community security risk assessment (CSRA) in alignment with PS4 and VPSHR expectations.

Land, Livelihoods and Displacement

Project development requires land and access rights for facilities, pipelines, quarries, roads and logistics corridors, largely within customary land tenure systems. Displacement risk is expected to be predominantly economic, arising from temporary or permanent restrictions on access to land, rivers, fisheries, sago gardens and other natural resources. Physical displacement remains possible in only one location - Pokore Hamlet however this is pending confirmation from further noise assessments. Mitigation will include clan land use compensation, and the development of livelihood restoration and improvement measures tailored to PAoI-specific contexts. Key mitigation instruments, including Land Access and Livelihood Development Plans (LALDPs), define entitlements, compensation values and delivery mechanisms, livelihood restoration, benefit-sharing measures and monitoring indicators. Should physical displacement be necessary at Pokore Hamlet, the Project will follow IFC PS5 and obtain FPIC from both affected households and, where relevant, host communities (IPF 2026) and develop appropriate Resettlement Action Plan (RAP).

ICP and FPIC processes, participatory mapping of restoration measures and ensuring livelihood program implementation includes safeguards for vulnerable groups are intrinsic elements of the ongoing plans. For upstream and coastal communities, the residual impacts on livelihoods regarding land or natural resources access, potential disturbance to ecosystem services and damage of assets have been assessed as Minor or Negligible. Impacts due to economic opportunities have been assessed as either minor or positive.

Indigenous Peoples

Although the Government of Papua New Guinea does not refer to its citizens as Indigenous Peoples, most communities within the PAoI meet the IFC PS7 criteria for Indigenous Peoples. Accordingly, this ESHIA Synthesis uses the term "Indigenous Peoples" in accordance with IFC PS7. Indigenous Peoples are present throughout the PAoI, with strong cultural, spiritual and livelihood connections to customary land, riverine, and marine environments. Risks relate to impacts on customary land and resource rights, cultural identity, decision-making processes, and equitable participation in Project benefits. The Project applies FPIC where applicable, supported by an Indigenous Peoples Framework (2026), hereafter referred to as IPF (2026), an ICP/FPIC Implementation Plan (2025), Land Access and Livelihood Development Plans (LALDPs), cultural heritage management measures and grievance mechanisms integrated with land access processes and livelihood restoration processes. Residual impacts are expected to remain localised and depend on the effective implementation of ongoing ICP/FPIC, inclusive representation, and transparent benefit delivery. They mainly relate to potential erosion of cultural identity and connections to ancestral lands and culturally significant environments arising from land disturbance, environmental change, restricted access and pressure on surrounding communities as a result of PIIM.

Cultural Heritage

Tangible and intangible cultural heritage values are present across the Project area, including sacred landscapes, burial grounds, archaeological sites, ancestral settlements and riverine and coastal cultural sites. Cultural heritage is closely intertwined with indigenous identity, customary land and water tenure, livelihoods and spiritual practices. Cultural heritage sensitivity is highest along the Purari River, Orokol Bay, and other riverine/coastal corridors, where cultural practices are strongly tied to land-water interfaces and where archaeological material is most prevalent. Risks include disturbance or restricted access to these sites during construction, particularly for pipeline corridors, quarries, dredging, and barging activities. Mitigation is centred on implementation of the Cultural Heritage Management Plan (CHMP) which applies an avoidance-

first approach supported by pre-construction cultural heritage surveys, archaeological salvage where avoidance is not feasible, Chance Finds Procedures, indigenous participation and, where applicable, ICP/FPIC with customary custodians. Residual impacts remain predominantly Minor to Moderate owing to the high sensitivity and irreplaceability of many cultural heritage receptors, even where avoidance, salvage and other mitigation measures are applied. One Major residual impact remains at the Purivo Junction of the Purari River, where temporary changes in sandbank morphology may affect a sacred site. The impact remains significant due to the very high sensitivity of the location rather than inadequate mitigation, and is managed through avoidance where feasible, ongoing consultation, implementation of the CHMP, and adaptive management, enabling intermittent access for cultural practices adapted to construction activities and safety requirements.

Cumulative Social Impacts

Potential cumulative social impacts arise primarily through interaction with other existing and reasonably foreseeable resource developments in the region. These include population in-migration, increased pressure on land, livelihoods, community services and transport corridors, as well as cumulative effects on riverine and coastal resource use, community health, and traditional cultural practices. While the Project's incremental contribution to these cumulative impacts is generally assessed as Minor, effective management will require continued implementation of Project mitigation measures together with coordination between government, industry and other stakeholders to address broader regional development pressures through adaptive management and cumulative impact monitoring.

1 Introduction

1.1 Purpose and Objectives of the ESHIA Synthesis

The following Environmental, Social and Health Impact Assessment (ESHIA) Synthesis has been prepared for TotalEnergies EP PNG Limited (TEP PNG), as the operator of the Papua Liquefied Natural Gas (LNG) Project (henceforth, the 'Project'). The primary aim of the ESHIA Synthesis is to consolidate the material findings of the Project's E&S Assessments conducted to date into a condensed and readable format.

Supplementary objectives of the ESHIA Synthesis include:

- Support the Project to clearly communicate material E&S risks and opportunities and any efforts to address them
- Aid Lenders' due diligence for the Project
- Provide the Lenders' information they require to demonstrate compliance with their requirements, and to provide a document that can be used for Lenders internal approval procedures and external disclosure purposes to support financing of the project
- Be a document suitable for public and lender disclosure.

1.2 Scope of the Project

TEP PNG and its Joint Venture (JV) partners propose to commercialise the Elk-Antelope gas and condensate reserves in Petroleum Retention License 15 (PRL-15), located in Gulf Province, PNG. The Project will involve producing and processing the gas and condensate. The gas and condensate will be transported via pipeline onshore and then offshore in the Gulf of Papua. Once offshore the gas will be piped to the existing PNG LNG producing and exporting facility in Caution Bay, Central Province, and the condensate will be piped separately to an FSO. The design life for the Project is 30 years, 5 years of construction and 25 years of operations. The facilities will also undergo a decommissioning phase post this 30-year Project life.

The Project articulates design through 3 main components:

- **Upstream:** includes the wellpads and gas gathering system;
- **Midstream:** includes the Central Processing Facility (CPF) of the upstream production, a condensate export pipeline, up to the Pipeline End Manifold (PLEM), a flexible riser connecting the PLEM to a third-party FSO facility, and a gas export pipeline to the Downstream component;
- **Downstream:** composed of new and/or shared facilities with existing PNG LNG plant, including gas receiving and treatment facilities, gas liquefaction trains, and storage and export facilities for LNG. Naphtha (a by-product of the gas liquefaction).

TEP PNG is the operator of the Project on behalf of the JV partners. TEP PNG will design, construct and operate the upstream and midstream aspects of the Project – these are collectively referred to as the "Upstream Components" by the Project and within Project documentation. ExxonMobil PNG Antelope Limited (EMPNGA) will design, construct and operate, and seek approval for, the Project's downstream facilities.

This ESHIA Synthesis covers the Upstream and Midstream Components only, and it's these components that are referred to as "the Project" within this document.

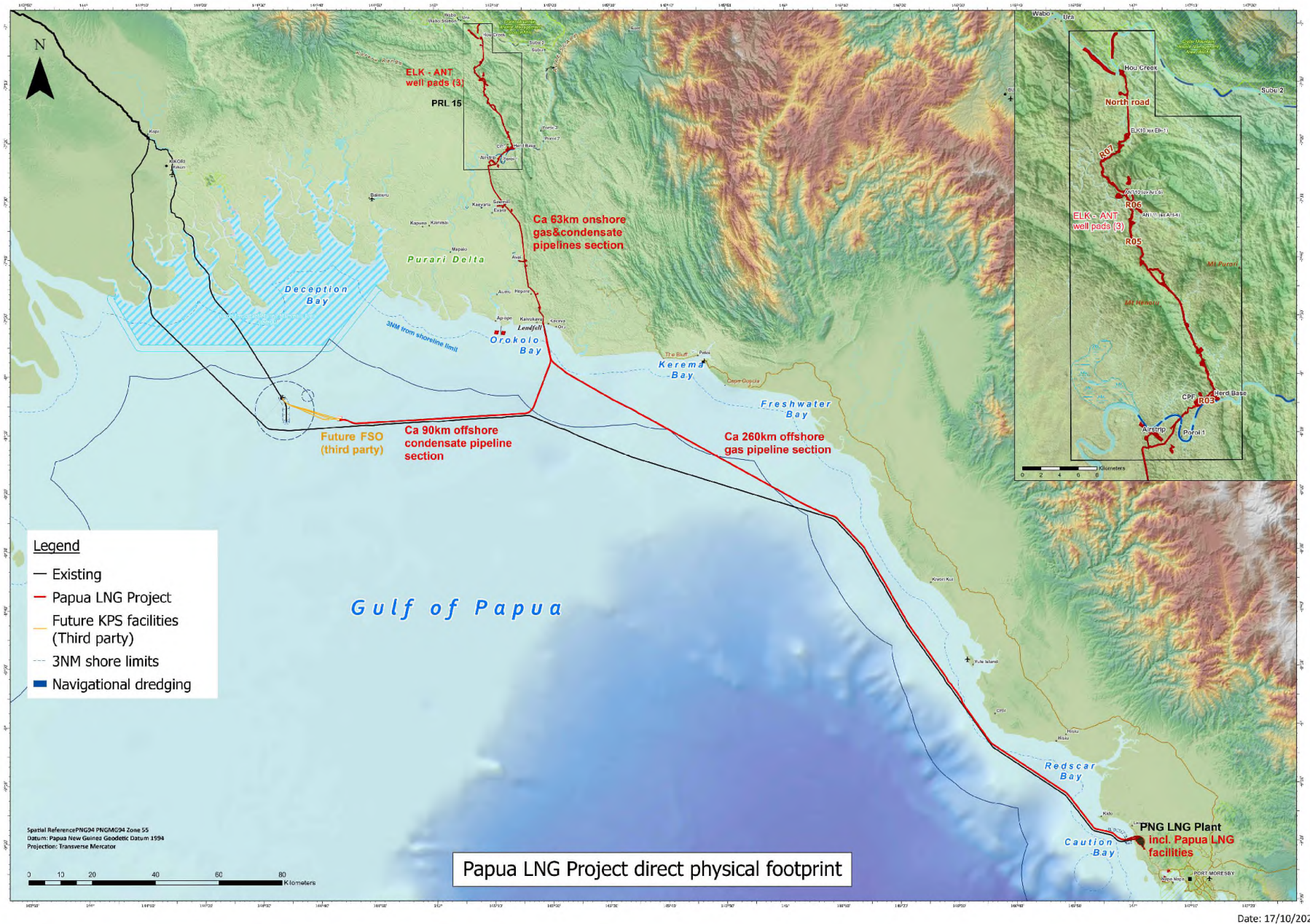


Figure 1-1: Papua LNG Project – Direct physical footprint (Source: TEP PNG, 2025)

1.3 Project History and Viability

PRL-15 has been under exploration for its gas potential for several years. The following provides a brief history of the exploration:

Table 1-1: A brief history of PRL-15 exploration

Year	Activity
2006-2008	InterOil corporation made gas discovery in Elk-Antelope gas field
2008-2012	InterOil drilled ANT-1, ANT-2 and ANT-3 wells. Subsequently InterOil proposed a development known as Elk-Antelope Gasfield Project. This proposed project did not proceed
2014	TEP PNG and Oil Search (now Santos) acquired interest in PRL-15
2014-2016	TEP PNG drilled ANT-4, ANT-5 and ANT-6 wells
2015	TEP PNG appointed operator of PRL-15
2016-2017	TEP PNG drilled ANT-7, and ExxonMobil completed acquisition of InterOil
2018	TEP PNG and JV partners signed a Memorandum of Understanding (MoU) with the government of PNG defining terms for the Gas Agreement for the Papua LNG Project
2019	Execution of the Gas Agreement with the government of PNG

These are considered legacy activities, without which the Project would not be viable. To support these exploration works, land clearance was undertaken for preparatory access roads, exploratory wells, helipads, and geotechnical excavation areas.

1.4 Layout of this Document

As a synthesis of a large number of E&S Project documents, this ESHIA follows the following layout:

- **Section 1: Introduction:** Sets out the purpose, scope and structure of this synthesis report, including its intended audience and limitations.
- **Section 2: Methodology:** Provides an overview of the methodology used to produce this report, as well as a summary of the E&S assessment methodologies applied by the Project.
- **Section 3: Project Description:** Describes the Project and its components, including the updated Project Area of Influence (PAoI), Associated Facilities and a synthesis of the Analysis of Alternatives (AoA).
- **Section 4: Regulatory Framework, Policies, Standards and Guidelines:** Summarises the applicable national legislation and international standards relevant to the Project, including lender requirements where applicable.
- **Section 5: Stakeholder Engagement:** Outlines stakeholder identification, engagement activities undertaken to date, and key issues raised by stakeholders.
- **Section 6: Baseline, Impact Assessment and Mitigations:** Presents the synthesised baseline conditions, impact assessment findings, and mitigation measures for each E&S topic. Topics are ordered broadly in line with the IFC PS (PS 1–8).
- **Section 7: Cumulative and Transboundary Impacts:** Synthesises the Project's assessments of cumulative impacts to date, as well as any transboundary considerations.
- **Section 8: Environmental and Social Management System (ESMS):** Summarises the Project's ESMS framework, including management plans, monitoring, and implementation arrangements.

- **Section 9: Conclusion:** Provides an overall summary of key findings, residual impacts, and the Project's alignment with applicable standards.

2 Methodology

2.1 Overview and Alignment

This document has been prepared to support the communication of TEP PNG's alignment with lender E&S requirements for assessment of environmental, social, and health risks, along with mitigation strategies. This document is produced to create a concise and readable synthesis of the extensive E&S documentation that the Project has produced to date.

The process to produce this document can be summarised as follows:

- Review EIS (2019), and more recent existing E&S documentation (see Section 2.2).
- Synthesise the main relevant data compliant to the applicable standards into this ESHIA Synthesis.

The production of the ESHIA Synthesis was entirely desk-based and utilising information and reports provided by TotalEnergies. This ESHIA Synthesis does not include any new baseline data gathering or interpretation, community & stakeholder engagement and/or detailed impact assessment for TEP PNG. It is a summary of existing Project documentation only.

Mitigation measures for Project impacts were presented as part of EIS Vol. 1 Ch. 20 Commitments Register, 2019 hereafter referred to as EIS Commitments Register (2019). This ESHIA Synthesis includes mitigation measures from the EIS (2019) as well as measures outlined in key E&S assessments since, including the EIS Addendum (2024), FEED Changes EAR (2025), D&B ESIA (2025), and the Hou Creek Aggregate Dredging EAR (2025). It is noted that some of the mitigation measures described within this ESHIA Synthesis have already been implemented by the Project.

2.2 Data Sources and Consultation Inputs

This synthesis has been compiled using the following key documentation:

- EIS (2019) prepared by ERIAS, which was submitted to support the environment permit application process for the upstream Project. The EIS was submitted to the Conservation & Environment Protection Authority (CEPA) on 13 December 2019.
- Environmental and Social Baseline Studies completed between 2016 and 2018 by ERIAS in support of the EIS (2019).
- EIS Addendum (2024): which provided revisions to the EIS (2019) based on established design changes. The document was submitted to CEPA to address two substantial changes since the EIS (2019) was submitted. These changes were the relocation of the CPF and a revised acid gas management strategy.
- Purari River Dredging and Barging Environmental and Social Impact Assessment prepared by BMT in August 2025, (D&B ESIA (2025)).
- FEED Changes EAR (2025): produced by ERIAS in October 2025 to describe the E&S impacts associated with notable changes in design through FEED, including the re-routed offshore condensate pipeline, additional compressor at the CPF, a revised offshore export pipeline route that avoids crossing the PNG LNG pipelines, trenchless construction for Caution Bay landfall, an increase in the number of dredging locations in the Purari River, and the construction of 5 borrow pits and access roads.

- Hou Creek Aggregate Dredging EAR (2025): produced by ERIAS in December 2025 to describe the E&S impacts associated with the proposed aggregate sourcing near Hou Creek.
- A variety of additional documents detailing design changes since 2019, additional E&S studies, and management plans and procedures that feature content relevant to assessment and management of E&S risks and impacts. In total over 410 documents have been reviewed as part of the assignment. The specific documents used to inform this ESHIA Synthesis are referenced in standalone Appendix B.

Documents assessed for biodiversity include Critical Habitat Assessments Summary, 2025, hereafter referred to as CHA Summary (2025), Freshwater Critical Habitat Assessment, 2025, hereafter referred to as Freshwater CHA (2025), Marine Critical Habitat Assessment, 2025, hereafter referred to as Marine CHA (2025), Residual Impact Assessment, 2025, hereafter referred to as RIA (2025), Net Gain Feasibility Study (Earth Active), 2025, hereafter referred to as Net Gain Feasibility Study (2025) all produced by Earth Active Ltd in 2025, Biodiversity & Ecosystem Services Strategy (2023), hereafter referred to as BESS (2023), Terrestrial Critical & Natural Habitat Assessment (2025), hereafter referred to as Terrestrial CHA (2025).

2.3 Approach for Identifying & Assessing Impacts

2.3.1 Overview of Key Steps in Assessment

The EIS (2019) undertook the following steps:

1. Screening of E&S values, and potential impacts, at a high level
2. Scoping and defining the PAoI and study area. This includes an AoA
3. Characterizing the baseline environmental and social setting
4. Impact assessment, including identifying potential Project impacts, determining mitigation measures, and assessing the significance of residual impacts. The impact assessment includes evaluating potential cumulative impacts
5. Reporting of the Environmental and Social Impact Assessment (ESIA) Process, i.e. the EIS (2019).

The impact assessment undertaken in the EIS (2019) and the EIS Addendum (2024) were based upon the following three assessment methods:

- Compliance standard assessment for predicted impacts where appropriate quantitative criteria and guidelines exist against which to evaluate risk, e.g., air quality, noise, water quality.
- Significance assessment for expected impacts where quantitative assessment criteria do not exist.
- Assessment of unplanned, accidental or abnormal impacts.

These are briefly described in more detail below.

2.3.2 Environmental Impacts Assessment Method

The approach taken to assess environmental impacts can be summarised below:

- **Baseline Identification:** Environmental conditions were characterised combining desktop review of available literature, field surveys, specialist studies and participatory engagement. Existing datasets (national environmental reports, previous project studies, biodiversity inventories, hydrology and water quality assessments, climate data, and marine ecology surveys) were reviewed to establish a comprehensive baseline for the PAoI. This baseline covers the physical environment (air, water, soil), biological environment (flora, fauna, invasive species, habitats), and ecosystem services, with

particular attention to sensitive receptors such as protected areas, critical habitats, and species of conservation concern (which includes International Union for the Conservation of Nature and Natural Resources (IUCN) Critically Endangered (CR), Endangered (EN), Vulnerable (VU), and Near Threatened (NT) species. IUCN Least Concern species have also been included if they are restricted range (RR), endemic or sensitive to disturbance or data deficient (DD₁)).

- **Impact Identification:** Project activities were mapped against the baseline conditions to identify environmental values and receptors, as well as to screen potential impact pathways. For each activity (e.g., site preparation, dredging, marine traffic, emissions, waste management), the assessment details which environmental components may be affected, the mechanisms of impact, and the spatial and temporal scales involved.
- **Impact Evaluation:** The significance of environmental impacts was assessed using a matrix approach aligned with PNG's Environment Act 2000 and IFC PS. This process produced significance ratings (negligible to major) for both unmitigated and mitigated scenarios, explicitly considering cumulative effects and climate change implications.
- **Mitigation and Management:** Mitigation measures follow the mitigation hierarchy and are embedded in the Project's ESMS. For each material impact, the assessment identifies avoidance and design modifications (e.g., routing to avoid sensitive habitats), minimisation measures (e.g., erosion control, emissions reduction, waste segregation), restoration actions (e.g., habitat rehabilitation), and, where appropriate, offset or enhancement initiatives (e.g., biodiversity conservation programs, mangrove restoration). Residual impacts, monitoring indicators, and responsibilities are defined within the Project's topic-specific management plans.
- **Climate and Cumulative Considerations:** The assessment incorporates Greenhouse Gas (GHG) accounting and climate resilience analysis, ensuring alignment with international commitments and national climate strategies. CIA evaluates combined effects of Project activities with other developments in the region.

2.3.3 Social Impacts Assessment Method

The social impact methodology presented in this ESHIA Synthesis is a synthesis of methodologies and data documented in the Project's existing SIA, ESIA, baseline, management, and topic-specific studies.

Given that the Project's social evidence base was developed through multiple studies over time, the methodologies vary between social topics. The EIS (2019) provides the principal social impact significance framework, under which impact magnitude is considered in terms of extent, duration, reversibility, severity, frequency, and the number of people affected, and receptor sensitivity is considered in terms of social, human, natural, physical, and financial capital, formal or customary status, vulnerability, and capacity to adapt. Impact significance is determined by combining magnitude and sensitivity, with residual impacts assessed after mitigation (where the source assessment provides this information).

Complementary topic-specific studies provide additional methods for particular social themes, including social mapping and project impacted clan identification, fisheries and waterways baseline surveys, stakeholder engagement and grievance management, land access and compensation processes, Informed Consultation and Participation (ICP) / Free, Prior and Informed Consent (FPIC) processes, cultural heritage surveys and significance ratings, project-induced in-migration (PIIM) assessments, security risk assessment, and human rights impact assessment.

For each social topic, this ESHIA Synthesis applies the following approach:

- Identify the source document(s) used for baseline, receptor identification, impact identification, mitigation, and residual impact conclusions

- Retain the impact significance, residual impact, and mitigation conclusions stated in those source document
- Describe the method used in the source document, where it is stated
- Identify where a source document provides baseline, engagement, receptor identification, mitigation, or monitoring information but does not state a full significance assessment method
- Avoid re-rating impacts, extrapolating between topics, or revising any methodological variations.

Accordingly, the social sections of this ESHIA Synthesis should be read as a consolidated account of TEP PNG's prior social assessment work. The ESHIA Synthesis harmonises the presentation of varying methods by describing them against common headings: baseline and receptors, impact pathways, sensitivity or vulnerability, magnitude or severity, significance, mitigation linkage, residual impact, and cumulative effects.

Social Assessment Reporting Areas

To support consistent assessment and reporting across social topics, the ESHIA Synthesis groups social receptors and impact pathways by Project related facilities or areas. These reporting areas provide a practical structure for describing differences in Project activities, settlement patterns, customary land and resource use, exposure, sensitivity, engagement requirements, and mitigation.

The PAol is discussed using the following Project areas:

- **PRL-15:** covering the proposed Application for Petroleum Development Licence (APDL), Application for Pipeline Licence (APL) Application for Petroleum Processing Facility Licence (APPFL) /CPF-related licence areas
- **Onshore PER Northern Segment - Evara Area**, including Evara, Kaevaria, and Mapaio land interests
- **Onshore PER Mid Segment - Muro Area**, including Hepere, Ere, Kilavi, Laekoro, Paevera, Arehava 2, Avavu, Huruta, Aivai, and Aumu
- **Onshore PER Southern Segment - Orokolo Coast**, where Orokolo Coast and Ahia clan interests and communal land use are identified
- **Offshore PER**, including customary fishing zones from Orokolo Bay toward Caution Bay
- **Waterways/river transport corridors** along the Purari, Urika-Ivo and Port Romilly-Wame-Varoi rivers
- **Growth Centres** as areas that may be facing PIIM or existing in-migration and / or may experience other indirect social change.

2.3.4 Significance Assessment Method

Where quantitative criteria were absent, a qualitative significance assessment was used. This focused on credible and likely impacts, particularly those of concern to stakeholders. Significance was established by combining magnitude and sensitivity using a defined matrix (e.g. Table 2-3). Magnitude and sensitivity were defined as follows:

- Magnitude of impact: very high, high, medium, low, minimal, positive
 - o This was defined based on:
 - Nature (positive or negative)
 - Type (direct, indirect, induced, cumulative)
 - Severity of change (the scale or degree of positive or negative change from the existing condition due to the impact)
 - Geographical extent (site, local, regional, widespread)

- Duration (short-, medium-, long-term) and reversibility.
- Sensitivity of the affected value/receptor (very high, high, medium, low, minimal)
 - o Determined by:
 - Formal/legal or recognised status
 - Rarity or uniqueness and vulnerability
 - Resilience to change
 - Importance to communities or cultural value systems.

For residual impacts, magnitude was assessed after mitigation; sensitivity generally remained unchanged unless susceptibility was reduced by project actions. Residual impacts rated moderate or above were considered significant.

The following tables show the significance matrices used for the different impact assessment disciplines described within this ESHIA Synthesis.

Table 2-1: Significance assessment matrix for soil, terrestrial, freshwater and estuarine biodiversity, hydrology and marine (Source: EIS Impacts terrestrial (2019))

Magnitude of Impact	Sensitivity of Value				
	Very High	High	Medium	Low	Minimal
Very High	Severe	Major	Major	Moderate	Moderate
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Minor
Low	Moderate	Moderate	Minor	Minor	Negligible
Minimal	Minor	Minor	Negligible	Negligible	Negligible

Table 2-2: Significance assessment matrix for ecosystem services and social significance (Source: Hou Creek Aggregate Dredging EAR (2025))

Magnitude of Impact	Sensitivity of Value		
	High	Medium	Low
Very High	Severe	Major	Moderate
High	Major	Moderate	Moderate
Medium	Moderate	Moderate	Minor
Low	Minor	Minor	Minor
Minimal	Negligible	Negligible	Negligible
Positive	Positive	Positive	Positive

Table 2-3: Significant assessment matrix for cultural heritage (Source: Hou Creek Aggregate Dredging EAR (2025))

Magnitude of Impact	Sensitivity of Value		
	High	Medium	Low
Very High	Severe	Major	Moderate
High	Major	Moderate	Moderate
Medium	Moderate	Moderate	Minor
Low	Moderate	Minor	Minor
Minimal	Minor	Negligible	Negligible
Positive	Positive	Positive	Positive

Table 2-4: Significant assessment matrix for commercial traffic and transport (Source: EIS Impacts, Amenity and Climate Change (2019))

Magnitude of Impact	Sensitivity of Value		
	High	Medium	Low
Very High	Severe	Major	Moderate
High	Major	Moderate	Moderate
Medium	Moderate	Moderate	Minor
Low	Moderate	Minor	Minor
Negligible	Minor	Negligible	Negligible

2.3.5 Additional Methodological Considerations

Assessment of Unplanned, Accidental or Abnormal Impacts Method

Major hazards from accidental or abnormal events were identified through SENVID (Social and Environmental Impact Identification) and HAZID (Hazard Identification) studies. These considered all project phases and identified prevention, control, and mitigation measures for unplanned impacts.

2.3.6 Compliance Standard Assessment Method

For impacts where recognised quantitative standards were available (e.g., emissions, discharges, ambient noise), predictions were modelled considering feasible mitigation measures. Results were compared against relevant PNG regulations, IFC, World Health Organization (WHO), or other international/good industry practice criteria discussed in Section 4.

The recognised quantitative standards and relevant impact criteria for air quality, and noise, are presented here.

Air Quality

The CEPA's Technical Guideline (Additional Information) for Air Discharges (IB-ENV/02/2004) provides a framework for the assessment of air emissions associated with proposed developments, including requirements for the characterisation of emission sources, control measures, and the prediction of ground-level pollutant concentrations. However, it is noted that the guideline does not specify ambient air quality criteria against which predicted impacts can be assessed.

In the absence of statutory ambient air quality standards in PNG, appropriate assessment criteria have been adopted from internationally recognised guidelines. These include the World Health Organization air quality guidelines (2021), the IFC General Environmental, Health and Safety Guidelines (2007), and national standards published by the United States Environmental Protection Agency (2016, 2017). Where multiple criteria are available, the most stringent values have been selected to provide a conservative basis for assessment. For pollutants such as VOCs where limited criteria exist, screening levels from TCEQ (2018) have been applied.

The Project ambient air quality criteria are presented in Table 2-1.

Table 2-5: Ambient air quality criteria

Pollutants	Averaging Period	Limit (µg/m³)	Source
NO ₂	1-hour	200	WHO (2021)
	24-hour	25	
	Annual	10	
SO ₂	10-minute	500	WHO (2021)
	1-hour	200	US EPA (2016)
	24-hour	40	WHO (2021)
CO	1-hour	35,000	WHO (2021)
	8-hour	10,000	
	24-hour	4,000	
Benzene	1-hour	170	TCEQ (2018)
	Annual	4.5	
Toluene	1-hour	4,500	
	Annual	1,200	
Ethylbenzene	1-hour	26,000	
	Annual	570	
Xylenes	1-hour	2,200	
	Annual	180	
TSP	24-hour	150	US EPA (2017)
	Annual	60	
PM ₁₀	24-hour	45	WHO (2021)
	Annual	15	
	24-hour	11.25 (25%)	IFC (2007)
	Annual	3.75 (25%)	
PM _{2.5}	24-hour	15	WHO (2021)
	Annual	5	
	24-hour	3.75 (25%)	IFC (2007)
	Annual	1.25 (25%)	

Note: Bold values represent changes in adopted assessment criteria. Values shown in parentheses for PM₁₀ and PM_{2.5} represent 25% of the applicable WHO ambient air quality guideline consistent with the IFC General EHS Guidelines (2007) recommended maximum project contribution (increment). Source: IFC and United States Environmental Protection Agency (US EPA)

Noise and Vibration

The CEPA Technical Guideline (Additional Information) for Noise Discharges (IB-ENV/03/2004) provides a framework for which noise from a facility can be predicted; however, it is noted that the guideline provides

no specific criteria against which noise can be assessed. In lieu of any PNG mandatory noise criteria, noise targets have been sourced from the TotalEnergies General Specification document GS EP ENV 001 Environmental requirements for project design and E&P activities (TOTAL, 2011), Section 5.9 'Noise level', which provides suitable noise targets for the operations phase based on the WHO Guidelines for Community Noise (WHO, 2008) and the IFC (World Bank) Noise Management Guidelines (IFC, 2007).

The Project noise criteria are given below Table 2-2.

Table 2-6: Project noise criteria (Adapted from: EIS Noise Modelling, 2019)

Activity / Guidelines	Noise Criteria (Day/Evening 7:00 am to 10:00 pm)	Noise Criteria (Night 10:00 pm to 7:00 am)	Comment from EIS Noise Modelling 2019
Construction Noise	55 dBA Leq (long-term target, i.e., for works that could impact a receptor for longer than 1 month); 75 dBA Leq (short-term target for all daytime works)	45 dBA Leq	As an overall long-term target, noise management levels equivalent to the general operational noise limits have been nominated. A higher limit of 75 dBA, Leq has also been nominated for short-term daytime construction works. Where noise exceeds this upper threshold the receiver is considered 'highly noise affected', and all feasible and reasonable noise management and mitigation measures should be considered to help reduce the impacts. Some measurable adverse reactions may be expected from some fauna species when industrial noise levels reach 50 dBA Leq and these reactions can be expected to be notably greater (level of response, number of species responding) at 65 dBA Leq. However, given the uncertainty regarding noise impacts on fauna and species variation, definitive noise criteria for fauna cannot be defined and impacts cannot be looked at in isolation of other impacting processes
Operational Noise	55 dBA Leq	44 dBA Leq	The criteria is the lower of: Average night background level (L90) + 3 dBA OR 45 dBA Leq. Background noise monitoring results at the closest villages/settlements to the CPF during the critical night period were typically between 41 dBA and 47 dBA, L90. Based on the quietest noise levels of 41 dBA, the lower night-time noise criteria is therefore 44 dBA, Leq(1h). Some measurable adverse reactions may be expected from some fauna species when industrial noise levels reach 50 dBA Leq and these reactions can be expected to be notably greater (level of response, number of species responding) at 65 dBA Leq. However, given the uncertainty regarding noise impacts on fauna and species variation, definitive noise criteria for fauna cannot be defined and impacts cannot be looked at in isolation of other impacting processes
Off-site Target (facility boundary)	55 dBA Leq	45 dBA Leq	Pre-existing background noise limit at facility boundary not relevant.
IFC Guidelines (nearest receptor)	55 dBA Leq (for residential, institutional,	45 dBA Leq (for residential, institutional,	Noise impacts should not exceed the levels presented, or result in a maximum increase in background of 3dB at the nearest receptor location off-site.

Activity / Guidelines	Noise Criteria (Day/Evening 7:00 am to 10:00 pm)	Noise Criteria (Night 10:00 pm to 7:00 am)	Comment from EIS Noise Modelling 2019
	educational receptors). 70 dBA Leq (for industrial and commercial receptors).	educational receptors). 70 dBA Leq (for industrial and commercial receptors).	

2.3.7 Criteria Specific Methodologies

The assessment of impacts to marine physical processes and selected social topics is outlined below. For social topics, the purpose of this section is to explain how the documented source methodologies have been synthesised and how each topic links, where stated, to impact significance, mitigation, and residual impact assessment.

Marine Physical

The assessment of impacts to marine physical processes, sediment transport, and marine water quality is based on a combination of quantitative modelling (including hydrodynamic and sediment dispersion modelling) and a qualitative significance framework and explored in Table 2-7 below. This approach differs from other topics such as air quality and noise, which rely primarily on quantitative assessment, by integrating model outputs with professional judgement.

Impact significance is determined by combining the magnitude of change with the sensitivity of the affected receptor. Impact magnitude considers the spatial extent, severity, and duration of change, ranging from negligible (highly localised, short-term changes within natural variability) to very high (widespread, long-term changes beyond natural variability).

A summary of the impact magnitude classification for marine physical is provided in Table 2-7 below.

Table 2-7: Impact magnitude descriptors and matrix relevant to marine physical and sediment processes, and marine water quality (Source: EIS Impacts Marine (2019))

Severity/Duration (1 = short-term within natural variability, 5 = long-term beyond natural variability)	Geographic Extent (1 = highly localised, 5 = widespread)				
	1	2	3	4	5
1	Minimal	Low	Medium	Medium	High
2	Low	Low	Medium	High	High
3	Low	Medium	High	Very High	Very High
4	Medium	Medium	High	Very High	Very High
5	Medium	Medium	Very High	Very High	Very High

Receptor sensitivity reflects the existing condition of the environment and its capacity to accommodate change. A summary of the sensitivity criteria applied is provided in Table 2-8. Full definitions of magnitude and sensitivity criteria are provided in Section 6.18 Biodiversity – Marine.

Table 2-8: Receptor sensitivity descriptors relevant to marine physical and sediment processes, and marine water quality (Source: EIS Impacts Marine (2019))

Rating	Descriptor
Very High	- Environment is in a natural condition with no evidence of modification; all environmental benchmarks are met. - Environment supports physical properties or processes that are considered rare or exceptional at a regional scale.
High	- Environment is in a near-natural condition with minimal human-induced modification; most environmental benchmarks are met. - Environment supports physical properties that are considered rare or exceptional at a local scale but well represented regionally.
Medium	Environment is in a near-natural condition with some human-induced modification; most environmental benchmarks are met. Environment supports physical properties or processes that are well represented at the local scale and experience low inter-decadal variability from extreme events (e.g., cyclones, floods).
Low	- Environment is moderately degraded compared to equivalent areas or as measured by environmental benchmarks. - Environment supports physical properties or processes that are resilient to change, experiencing extreme natural events (e.g., cyclones, floods) every few years.
Minimal	- Environment is highly degraded compared to equivalent areas or as measured by environmental benchmarks. - Environment supports physical properties or processes that are very resilient to change, experiencing extreme natural events (e.g., cyclones, floods) every year.

Traffic and Transport

Baseline conditions and impact assessment for traffic and transport were informed by a combination of literature review, secondary data analysis, targeted field surveys, and specialist studies undertaken for different Project components. These studies cover the Purari River system, Orokolo Bay, and the wider Gulf of Papua region, and provide information on river navigability, vessel types, and existing transport patterns. Where data gaps were identified, they were addressed through targeted river traffic surveys and social baseline surveys, including vessel counts and spatial mapping of transport activity.

The assessment of impacts to traffic and transport is based on a qualitative significance framework. Impact significance is determined by combining the magnitude of impact with receptor sensitivity, and likelihood where relevant.

Table 2-9: Commercial traffic and transport sensitivity of receptor criteria (Source: Impacts, Amenity and Climate Change (2017))

Category	Description
High	- Route that facilitates connectivity between cities or regional centres. - Route that supports more than 250 return trips per year. - Value (i.e., efficiency, safety and amenity) has limited or no capacity for increased use. - Value is unaffected by the impact prior to Project interaction. - Value provides the sole source of income for local businesses. - Many commercial operators depend on the value and cannot access nearby alternatives. - Value cannot be relocated or replaced or is not a type common in the surrounding region.
Medium	- Route that facilitates connectivity between townships or villages. - Route that supports 150 to 250 return trips per year.

Category	Description
	• Value (i.e., efficiency, safety and amenity) has some capacity for increased use. • Some sign of exposure to the impact is already evident for this value prior to Project interaction. • Value upon which commercial operators are occasionally dependent
Low	• Route that facilitates connectivity between other main transport connections. • Route that supports less than 150 return trips per year. • Value (i.e., efficiency, safety and amenity) has significant capacity for increased use. • Value is already affected by the impact prior to Project interaction. • Value upon which local people are rarely dependent for provision of food or income. • Commercial operators can access nearby alternatives to the affected value. • Value can be relocated or replaced or is a type common in the surrounding region.

Table 2-10: Commercial traffic and transport magnitude of impact criteria (Source: Impacts, Amenity and Climate Change, (2019))

Category	Description
Very High	• An impact that extends to a national level, lasting for more than 10 years, and prevents existing traffic using the route. • Significant negative changes to economic activities or access causing major economic loss or business closure. • Collision at sea causing the loss of life and property.
High	• An impact that extends to a regional level, lasting five to 10 years, and disrupts existing traffic using the route. • Noticeable temporary negative changes to economic activities or access causing moderate economic loss. • Collision at sea causing the loss of property.
Medium	• An impact that extends to a local level, lasting less than five years, and delays existing traffic using the route. • Temporary, partial interruption to economic activities or access causing minor short-term economic loss. • Incident resulting in a near miss.
Low	• An impact that is highly localised, predominantly contained in the PAoI, lasting less than five years. • Minimal or no interruption to economic activities or access and commercial activities. • Can be effectively mitigated through standard management controls.
Negligible	• No appreciable impact compared with baseline conditions. • The impact is within a normal range of variation.

Community Health and Safety

CHS methodology is synthesised from the EIS social impact framework, the Project's ESMS/CESMP processes, traffic and transport management documentation, PIIM assessments, stakeholder engagement records, grievance procedures, health service delivery partnerships and relevant health service delivery partnerships assessment material.

Baseline and receptors are identified from community and demographic baseline studies, village-level consultation, waterways and fisheries studies, transport baseline information, PIIM assessments, and community health and safety documentation.

Receptors include Project-affected communities, riverine and coastal users, vulnerable and disadvantaged groups, users of health and education services, communities exposed to workforce or traffic interactions, and communities affected by in-migration or pressure on services.

Impact pathways are identified from Project activities and social change drivers, including construction workforce presence, river and marine traffic, dredging and barging, road and aviation movements, in-migration, pressure on services, community exposure to safety risks, and interactions with security arrangements.

CHS impacts are assessed by Project phase and by Project area as described in Section 2.3.3. This structure reflects differences in settlement pattern, service accessibility, transport exposure, livelihood dependence, community vulnerability, landownership and Project activity profile across the PAoI.

Where the EIS social impact framework is the source, impact significance is based on the combination of receptor sensitivity and impact magnitude. Where later Community Health, Safety and Security (CHSS) related documents identify risks, controls, monitoring actions, or incidents but do not state a full significance method, the ESHIA Synthesis reports those documents as management or monitoring inputs rather than re-rating their impacts. Mitigation linkage is through the ESMS, CESMPs, CHSS management measures, PIIM management measures, traffic and transport controls, stakeholder engagement, grievance management, incident management, and monitoring.

Security

Security methodology is synthesised from Project security risk assessment material, IFC PS4 requirements, the VPSHR, PIIM assessments, stakeholder engagement information, grievance procedures, incident management requirements, EIS social impact assessment, and the Papua LNG Project Human Rights Impact Assessments (HRIA).

The security assessment approach identifies potential interactions between public or private security arrangements and Project Affected Communities (PACs), including direct and indirect effects on community safety, human rights, social cohesion, access, and trust in Project processes.

Where the source documents provide explicit severity, escalation, or incident classification criteria, these are reported as the applicable method. Where source documents describe security risks, controls, commitments, or future assessment requirements without assigning impact significance, this ESHIA Synthesis does not assign new significance ratings. Mitigation linkage is through security management measures, VPSHR-aligned controls, contractor requirements, grievance escalation, incident investigation, corrective action, stakeholder engagement, and monitoring.

Indigenous Peoples

The Indigenous Peoples methodology is synthesised from the EIS social impact framework, Social Mapping and Landowner Identification (SMLI) studies, community baseline studies, cultural heritage studies, fisheries and waterways studies, land access and livelihood planning, the Indigenous Peoples Framework, the ICP/FPIC Implementation Plan, FPIC verification material, PIIM assessments, and the HRIA Summary of Key Findings.

Baseline and receptor identification are based on documented Indigenous status, customary land and resource relationships, clan and genealogy information, cultural heritage values, livelihood dependence, community institutions, and stakeholder engagement records. The assessment considers impacts on Indigenous lands, territories and natural resources; cultural heritage and spiritually important places;

customary governance and decision-making; access to livelihoods and ecosystem services; and participation in Project decision-making, including ICP/FPIC.

For Indigenous Peoples, the source methodology includes both impact significance assessment and process-based thresholds. The EIS social impact framework combines magnitude and sensitivity where that framework is used. The ICP/FPIC methodology applies tiering and FPIC triggers based on the severity, duration, reversibility, and cumulative nature of impacts on Indigenous lands, resources, cultural heritage, relocation, livelihoods, and decision-making rights. The HRIA adds a human rights-based assessment lens.

This ESHIA Synthesis retains the classifications, triggers, and residual conclusions stated in the source documents. It does not infer FPIC status, assign new Indigenous Peoples impact ratings, or determine consent outcomes. Mitigation linkage is through ICP/FPIC, land access and compensation processes, livelihood restoration and development planning, cultural heritage management, grievance mechanisms, and ongoing engagement and monitoring. The Indigenous Peoples assessment uses the same named project-area framework as the land, livelihood and CHSS assessments.

Cumulative and Transboundary Impacts

Cumulative impacts were assessed in the EIS (2019) following IFC's Good Practice Handbook on Cumulative Impact Assessment and Management (2013), focusing on impacts recognised as important by science or affected communities. Assessment considered existing baseline conditions shaped by past and current activities, and the potential combined effects of the Project with other reasonably foreseeable developments and environmental stressors.

IFC PS6 and Net Gain Objectives for Biodiversity

The Project is committed to the ongoing alignment to the requirements of IFC PS6, through the construction, operation and decommissioning phases of the Project. To reduce and minimise impacts, mitigation measures described in this ESHIA Synthesis will be included within the relevant environmental management plans, implemented by the Project and its contractors and monitored throughout by TEP PNG.

To date, the Project's CHAs have identified a total of 176 species and ecosystems that qualify as CH, and as such required consideration whether qualifying for net gain inclusion. Amongst the CH species, 152 species are anticipated or predicted to experience significant adverse residual impacts requiring net gain under PS6. Further details of the Project's plans for net gain can be found in section 6.16.1.

See Figure 6-12 in section 6.16.1 for biodiversity strategy planning.

3 Project Description

3.1 Overview

Project design is based on a risk-management approach, considering geotechnical constraints (e.g., flooding, landslides risks, geohazards) and anticipating and avoiding, or where avoidance is not possible, minimising E&S impacts (e.g.: avoidance of sensitive features, physical and economic displacement, priority ecosystem services, and minimisation of project footprint, land clearing and disturbance, emissions and discharges).

Between 2019 and 2025, Project design has evolved through the FEED process due to engineering optimisation and to avoid and minimise E&S impacts. The following section presents a synthesis of Project facilities and activities within the Upstream Component and reflects the most recent Project design as of December 2025. See Figure 3-1 for a map of the Project area.

The current Project design should be understood as the outcome of progressive optimisation since the 2019 EIS. The most relevant design changes are those that avoid sensitive receptors where practicable, reduce the Project footprint, consolidate infrastructure, and improve the ability to manage construction and operational impacts. The design has evolved through updated engineering, alternatives assessment, environmental and social assessment, and stakeholder engagement inputs, with the mitigation hierarchy applied to avoid and minimise impacts before relying on restoration, compensation or offsets.

Section 3.1 describes the facilities, physical assets, transport and logistics, timing of Project activities, and workforce requirements of the Project that are likely to generate E&S risks and impacts. Associated Facilities are described in Section 3.6.

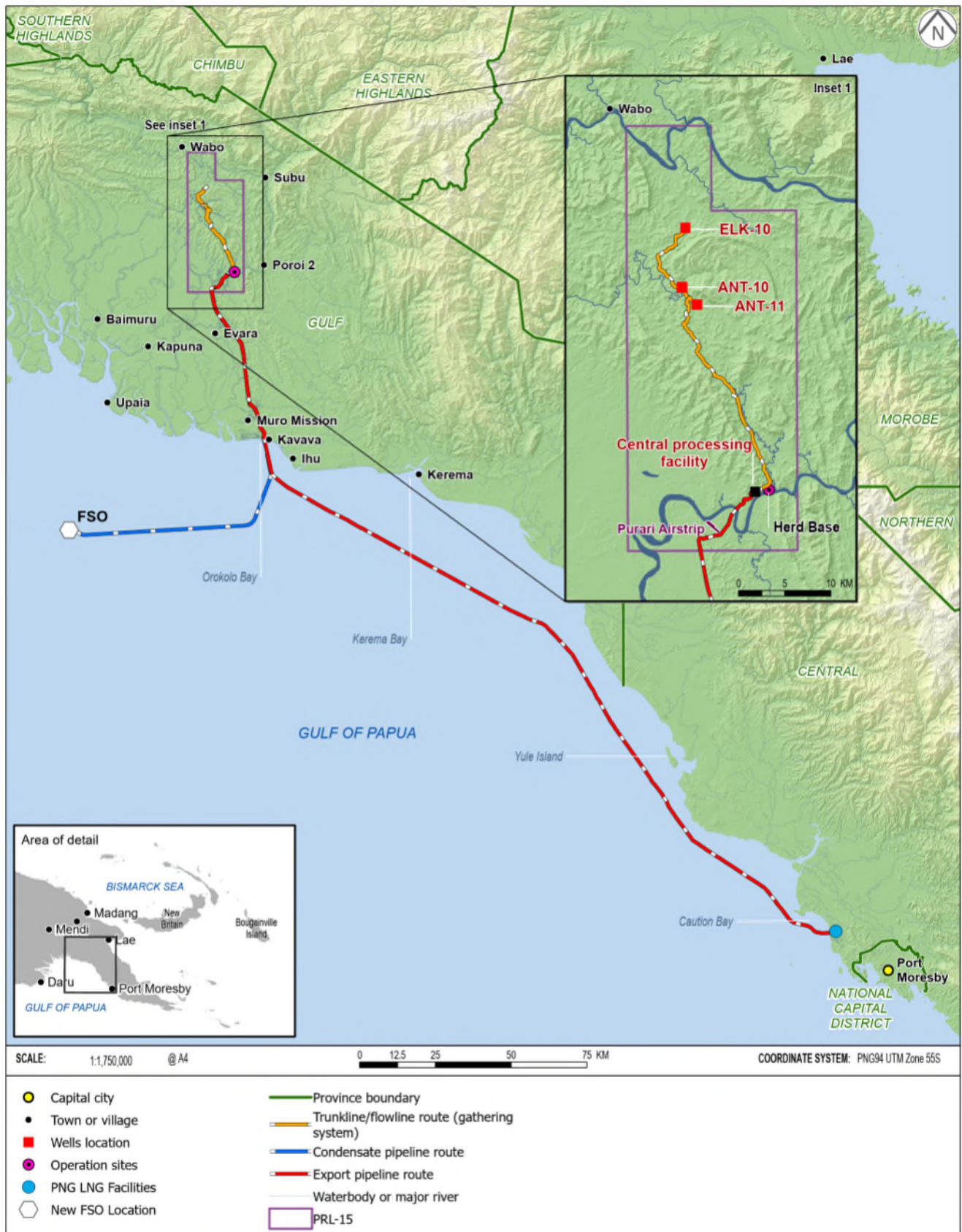


Figure 3-1: Project area map overview (Source: TEP PNG, 2026)

3.1.1 Wells, Wellpads, and Infield Pipelines

The Project will utilise three wellpads within the Elk and Antelope gas fields within the PRL-15 area. Two of these wellpads (ANT-10 and ELK-10) will produce reservoir fluids. The third (ANT-11) will be used as an injection wellpad for the reinjection of water and acid gas.

The three wellpads (Figure 3-2) will provide the following key functions:

- ELK-10 - two producer wells (designed to be suitable for both reservoir fluid production and acid gas injection. Will be converted to acid gas injection once the Elk Reservoir is depleted)
- ANT-10 - seven producer wells
- ANT-11 - acid gas injection well and produced water injection well, for the reinjection of acid gas and water.

Reservoir fluids will be transported from ELK-10 wellpad to the ANT-10 wellpad via two 14" diameter buried pipelines over a distance of approximately 10km. From the ANT-10 wellpad, the fluids will be transported to the CPF through two 22" buried pipelines over an additional distance of approximately 30km.

Elk fluid will be recompressed using an ejector installed at ANT-10 and a compressor installed at the CPF to further accelerate, and ensure sufficient depletion of, Elk Reservoir prior to its conversion into acid gas storage.

At the CPF, reservoir fluids will be separated into gas, condensate, water. Acid gases and water will then be processed and transported approximately 30km through a dedicated pipeline system (one 4" diameter pipe for water and 10" diameter pipe for acid gas) to ANT-11 prior to re-injection into the reservoirs. The pipelines will have a design life of 25 years.

A preliminary schematic of the ANT-11 wellpad is illustrated in Figure 3-3.

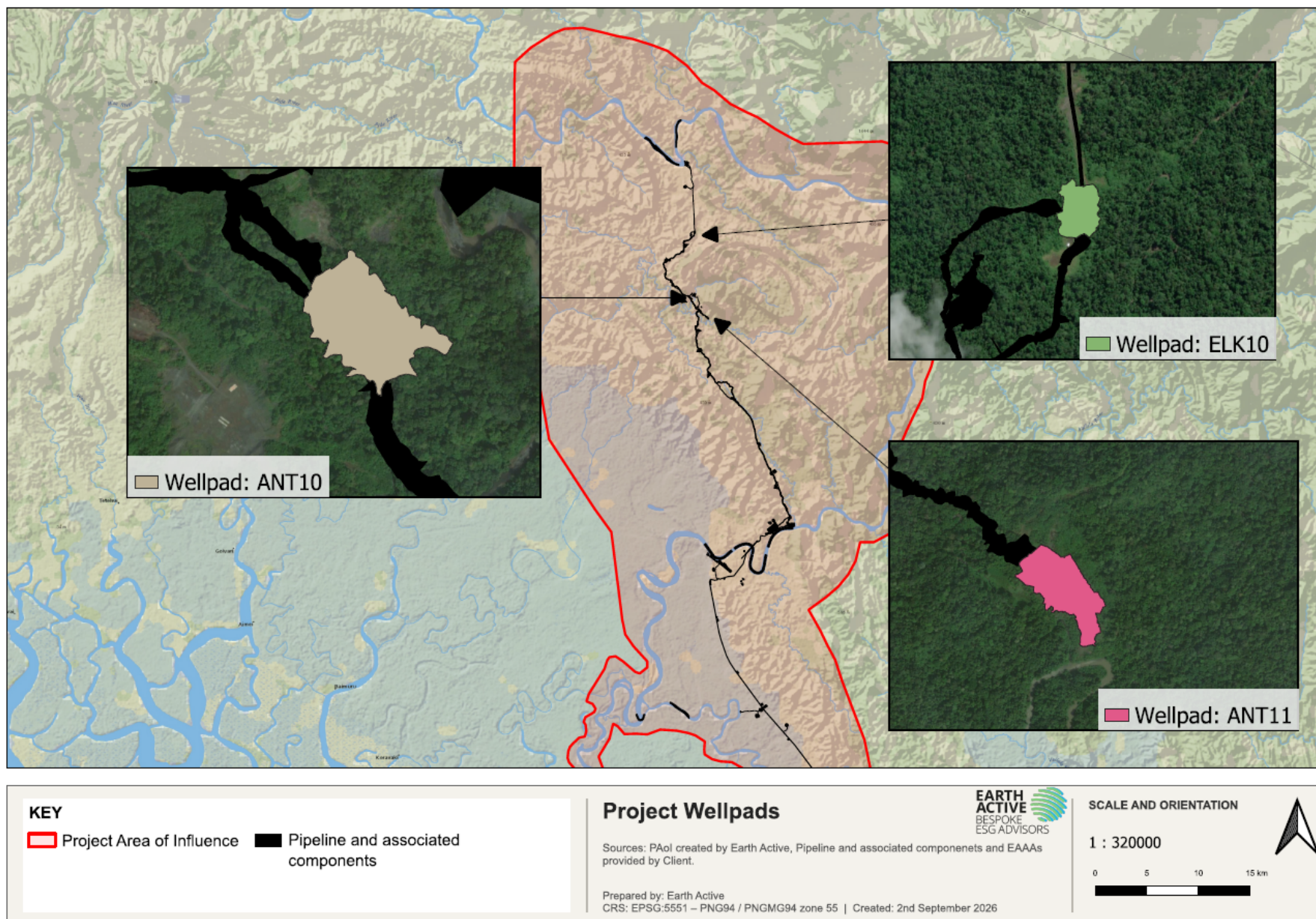
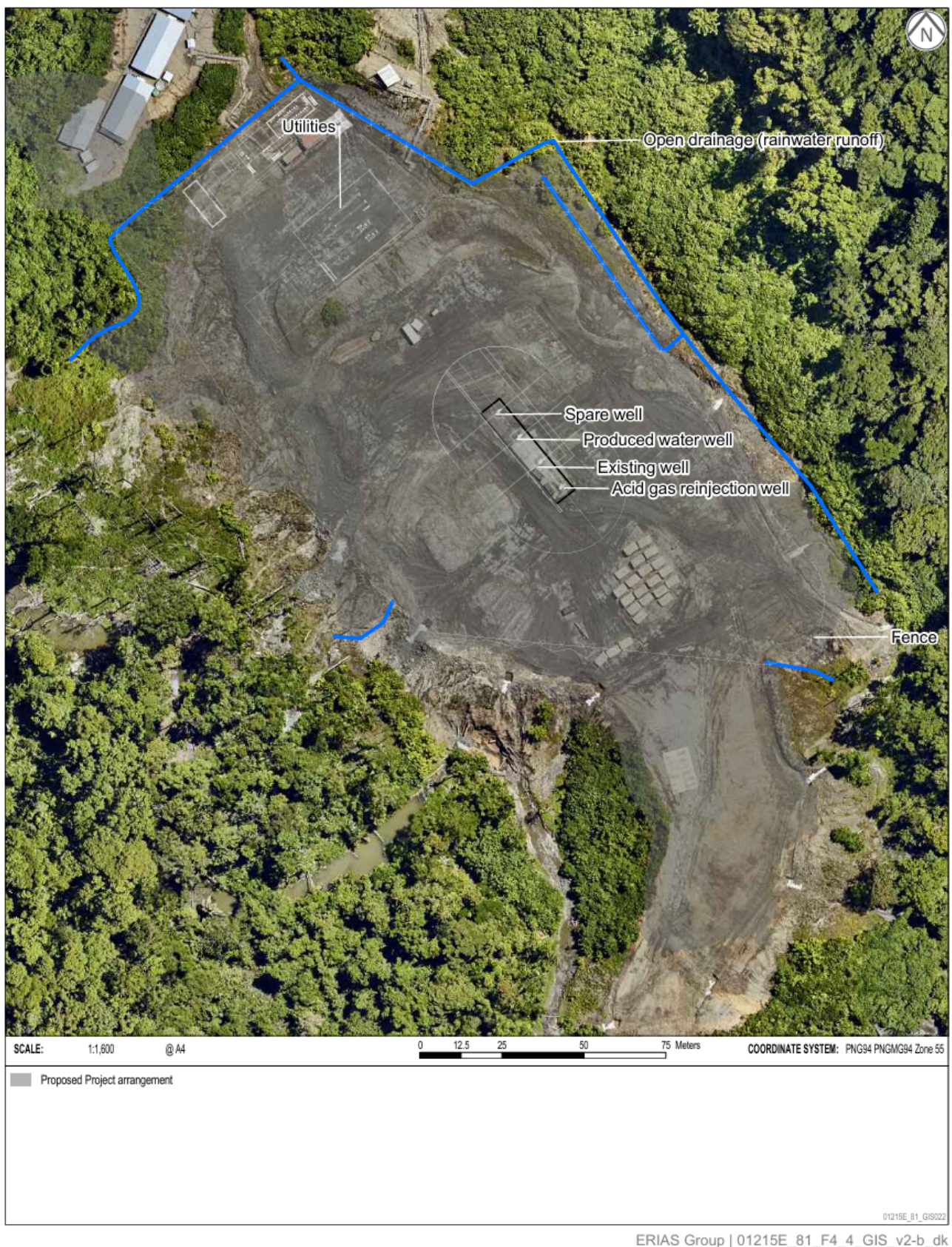


Figure 3-2: Locations of the ELK-10, ANT-10 and ANT-11 wellpads (Source: Earth Active Ltd, (2026))



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Figure 3-3: Ant-11 wellpad for illustrative purposes (Source: EIS Addendum, 2024)

3.1.2 Drilling

Drilling at the wellpads listed above will use drilling mud that acts as a lubricant to keep the drill bit cool and clean, lifts drill cuttings from the drill holes, and controls well pressure to prevent well blowout and borehole damage or collapse. The drilling will be performed using water-based mud. It will contain various chemical additives, but the selected mud composition design will be chloride free and favour environmentally friendly industry recognised chemicals to minimise the environmental impact and CO₂ emissions from the drill cuttings and mud solid treatment waste. The required water will be sourced from the nearest sustainable watercourse.

Shale shakers will be used to separate drill cuttings from the mud at the surface so the clean mud can be recycled. High performance shale shakers selection will be performed to optimise the drilling fluid recovery and recycling for the drilling process and therefore minimising the amount of waste generated.

A dewatering system will allow the removal of fine particles of solids from the spent water-based mud through a chemically enhanced process of enhanced centrifugation. The water outflow from the process will be recycled as much as possible to build new mud or used as sacrificial water injected in the well during the reservoir drilling. Any remaining quantities of processed water may be sprayed in the nearby environment, away from water sources, and only after testing confirms that they meet the required environmental specifications. Spraying would occur in very limited volumes per day.

Cuttings will be mixed with spoil then disposed at the spoil disposal areas described further below.

The precise drill package will be known consequent to the award of the drilling and the drilling mud contracts. The description provided follows industry best practice for the construction and installation of gas wells. The drilling rig site will typically accommodate a main derrick and substructure, power supply system (i.e., generators), flare area, drilling fluids and cuttings management area, which will also cater for equipment discharges, water storage areas, fuel storage, drilling pipe racks, suction pit, circulatory system (i.e., choke manifold, pumps, drilling fluid tanks and shale shakers), tanks for bulk mud products, cement and extra water, storage and truck equipment movement area, well control system (blowout preventer (BoP), and well monitoring system.



Photo: TOTAL.

Figure 3-4: Example of a project wellpad and drilling rig (source: EIS Addendum, 2024)

3.1.3 Central Processing Facility

The CPF will be located 120m to the north-west of the Purari River and will lie approximately 29km and 40km from the ANT-10 and ELK-10 wellpads, respectively.

The CPF will be located on a site known by the Project as “P3”. The existing landform at the CPF site is undulating with elevations ranging from 20 to 90m above sea level.

The Project will require land to site the CPF pad, the temporary construction areas (including the laydown and the construction camp) and restricted zones. The land required for the CPF temporary construction areas falls within the boundary of the planned permanent CPF perimeter, as such there will be no additional land requirement for temporary construction areas. Substantial earthworks will be required for pad levelling.

Restricted/exclusion zones around the CPF are yet to be defined but would not require additional clearing of vegetation. There is existing disturbance at the site associated with a pre-existing gravel pit, geotechnical drilling pads and access tracks. The site is otherwise covered with dense tropical forest and is intersected by approximately 600m of waterway within the western portion of the site, which will be permanently lost.

The CPF will comprise:

- Receiving facilities
- Gas and condensate processing for separate single-phase export,
- Processing and utilities areas,

- Condensate storage facilities,
- Flares and vents, and,
- Produced water and acid gas treatment.

Gas from the inlet facility is directed to the Acid Gas Recovery Unit (AGRU). The AGRU uses an Activated Methyl Diethanol Amine solution that effectively strips H₂S and CO₂ acid gases from natural gas. Acid Gas reinjection is planned from the start of production. During normal operations, there will be no routine flaring or venting; however, flares and vents will be necessary occasionally for specific situations such as start-up, maintenance and process upset situations.

The processing facilities will be positioned on the side of the CPF pad farthest from the river in order to reduce potential E&S risks and impacts to the river system. The flare stacks and a gas vent have been sited at the rear of the CPF maximizing the distance to communities and the Purari River, while respecting safety exclusion zones. Construction of the flare requires competent ground and for this reason the flare has been sited on a ridge, which also provides elevation and reduces the flare stack length.

Marine offloading facilities will be constructed on the Purari River immediately adjacent to the CPF. These include a Module Offloading Facility (MOF), Construction Offloading Facility (COF) and a ramp. Modules and other equipment for the CPF will be offloaded at these locations during construction and transported to the CPF.

A spoil disposal site will be required for excess and/or unsuitable CPF earthwork material. The final location is not yet confirmed but this spoil disposal site could be in the vicinity of the CPF or at Herd Base (see Herd Base description below).

3.1.4 Transporting the Gas and Condensate

Two export pipelines will be constructed that will separately transport the gas and condensate produced at the CPF. The gas pipeline will be 30" in diameter, and the condensate pipeline will be 10" in diameter. Approximately 2.4km from the CPF the two export pipelines will cross the Purari River using a trenchless approach (trenchless approaches under consideration include horizontal directional drilling (HDD), direct pipe and micro-tunnelling) with expected entry points approximately 100m away from the riverbanks. Both pipelines will be buried and will extend approximately 63km south from the CPF to Orokolo Bay on the Gulf of Papua coastline. A valve station will be situated at Orokolo Bay.

Once offshore in the Gulf of Papua, the alignments of the subsea gas and condensate pipelines will diverge. The gas pipeline will head south-east, extending approximately 260km to the inlet of the existing PNG LNG plant at Caution Bay, generally running alongside to the alignment of the existing PNG LNG pipeline. The PNG LNG plant is operated by Exxon Mobil and is a downstream component and out of scope of this ESHIA. For reference however, the Caution Bay plant will treat, liquefy and apply commercial specification to the gas.

The condensate pipeline will head south-west from Orokolo Bay extending approximately 90km to a third party operated FSO. Approximately 30km from the shoreline, the condensate pipeline will meet and then run alongside to the existing PNG LNG pipeline. The condensate pipeline will terminate at a PLEM with a riser connecting the PLEM to the FSO. The FSO is primarily intended to upgrade ageing Kutubu Pipeline System (KPS). The FSO would have been developed to support the KPS regardless of the existence of the Project. Pending finalisation of related commercial matters, the FSO is anticipated to become an Associated Facility at some point in the Project timeline (see Section 3.6).

From the shoreline at Orokolo Bay, both pipelines will be buried approximately 1m to 3m under the seabed until the water depth reaches approximately -10m, in order to protect them from potential incidents with marine vessels. From the section of the route where the water depth reaches approximately -10m depth and

beyond both pipelines will be laid directly on top of the seabed. The construction methods for the pipeline shore crossings will be open trenching at Orokolo Bay and HDD at Caution Bay.

Drill cuttings and drilling fluids (muds) will be generated by the HDD. The drilling fluids will be water-based muds and will contain bentonite, polymer additives, fine sediments. Drilling muds and cuttings will be contained in a closed-loop drilling system that collects, treats and reuses the fluids. At the completion of drilling, the recovered fluids and cuttings will be processed based on their classification. If deemed non-hazardous, cuttings may be repurposed for some construction activities.

3.1.5 Other Infrastructure Components

Development of other infrastructure components is proposed to support the construction and operation of the Project, including:

- 1. Roads:** A road network will be required between the various Project sites: CPF, wellpads, and Herd Base. These are designated as R3, R5, R6, and R7 (see Figure 3-5). Roads are planned to be co-located with pipelines where possible. In total, around 43km of roads will have to be constructed or upgraded. This road network will provide access for ongoing maintenance and security support throughout both the construction and operational phases.

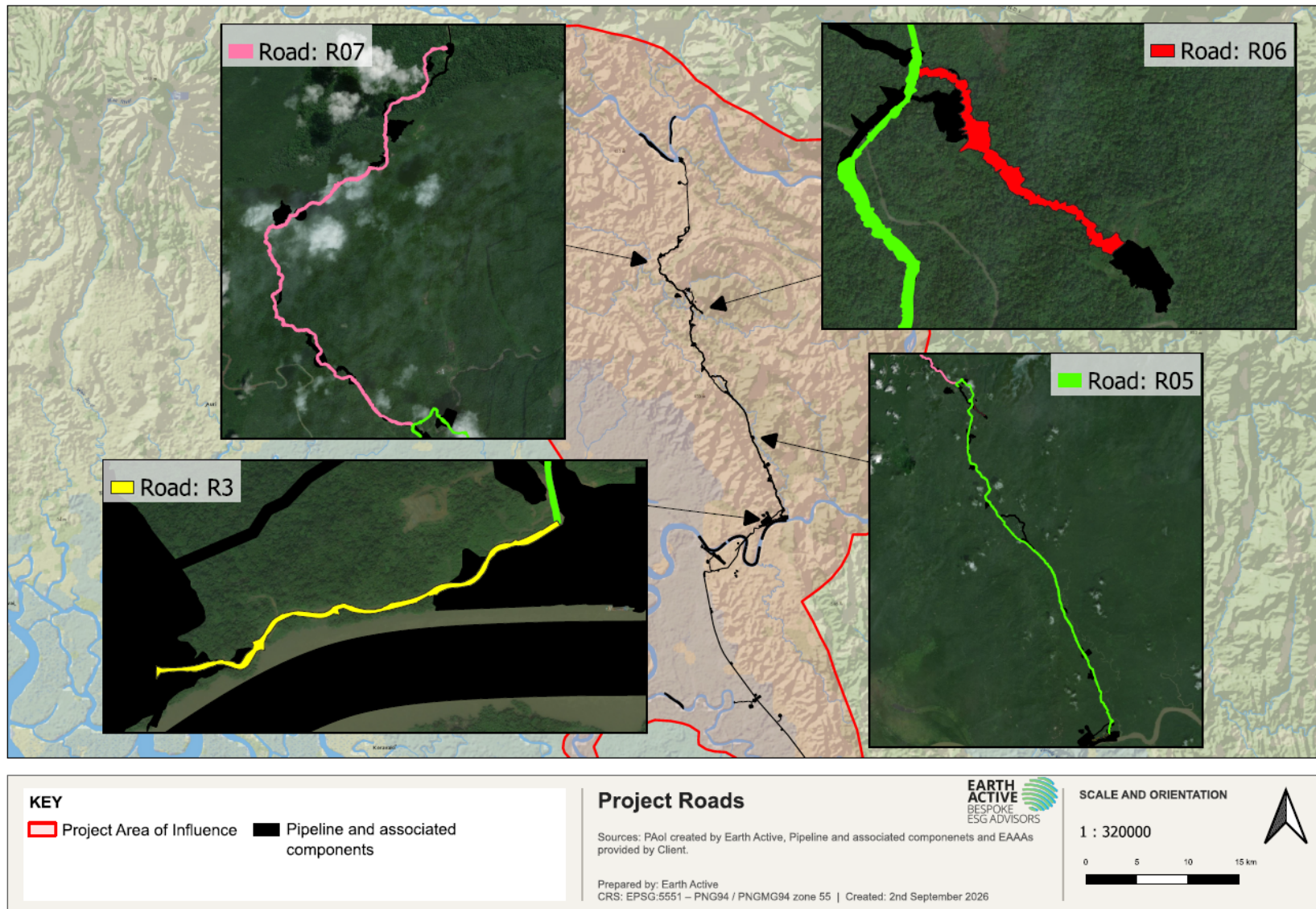


Figure 3-5: Map of roads (Source: Earth Active 2026)

2. **Herd Base and nearby infrastructure:** Herd Base, which is already established, is planned to serve as the main accommodation camp and will remain in place throughout both construction and operations. Herd Base will be expanded to include wharf facilities, an operations support area, additional camp infrastructure, and logistics areas, enabling it to support construction, drilling and production activities. See workforce requirements below for more detail on accommodation arrangements.
3. **Quarries and borrow pits:** The Project will require extensive civil works in greenfield areas to establish facilities, roads, wellpads and support sites. A range of aggregate materials comprising sands, gravels and rock are required for structural fill and stability, effective drainage, general fill and road course. General backfilling will primarily source fill material from borrow pits to minimise the need for aggregates. Aggregate requirements have been progressively refined and are currently estimated at 2.7MT of aggregate. The Upstream Project will need to establish multiple aggregate and fill material extraction sites within PRL-15 and adjacent to the export pipeline route, and possibly source material from new and existing facilities outside of PRL-15, to meet aggregate requirements. These extraction sites are categorised as either quarries, borrow pits, or aggregate dredging, with the following definitions:
 - Quarries and proposed aggregate dredging provide hard conglomerate rock (aggregate) and sand that can be processed for use as engineered fill and drainage materials. Based on the Project's alternatives assessment, aggregate extraction from the Purari River near Hou Creek has been identified as a preferred aggregate source due to its substantial resource availability, proximity to key construction areas, reduced transportation requirements and favourable overall balance of technical, environmental, social and commercial considerations. Commercial quarry sources in the Port Moresby area are retained as sources.
 - Borrow pits provide good quality fill material which can be excavated (by cut). Borrow pits have been identified within PRL-15 and along ridges outside PRL-15 where material can be extracted and are generally located within 5km of the pipeline route. There is a previously used and now exhausted borrow pit located within the perimeter of the proposed CPF site. It is estimated that 0.9MT will be required for other materials. The following sites borrow pit locations have been identified by the Project:
 - o PRL-15: Elk 2 wellpad and KP9 (near the Purari Airstrip)
 - o Export pipeline route: KP30, KP54, KP60.
4. **Stockpile and laydown areas:** Several stockpile and laydown areas will be required within PRL-15 and along the pipeline export route for the storage of materials required for construction activities. This includes areas for temporary topsoil stockpiles, permanent spoil disposal, pipe storage and construction laydown areas. Pipe storage yards and construction laydown areas will be located close to construction camps and marine offloading facilities.
5. **Spoil disposal areas:** Spoil disposal areas will be used for the permanent placement of excess spoil generated from construction of Project roads and the pipeline Right-of-Way (RoW). Currently 13 spoil disposal areas have been identified in PRL-15 and 12 along the pipeline export route, equalling 25 in total (these are in addition to the spoil disposal area for the CPF described above).
6. **Landfills and waste management areas:**
 - A proposed site is located along R05 and shares the location of a previously cleared works area. The landfill will accommodate general non-hazardous waste, and have an estimated capacity of 50,000m³. The specific location will be determined as Project design progresses.

- Hazardous waste (also referred to as Restricted waste) will be removed from site for management in Port Moresby (transported by barge), or overseas if facilities in Port Moresby are not deemed to meet Project waste management requirements.
- During construction, contractors may be required to mobilise a containerised incinerator(s) to site to manage waste. These incinerators will be located within the construction contractor areas and designed to internationally recognised standards such as IFC Environmental, Health and Safety Guidelines for Waste Management Facilities (IFC, 2007).
- During operations, waste will be managed at Herd Base according to environment permit conditions (Level 3 Environment Permit L3 (1030)) and an operations Waste Management Plan.

- 7. Helipads:** Helipads will be located at strategic points across the Project area, including several along the export pipeline route.
- 8. The Purari Airstrip:** The Purari airstrip is an established facility that is currently utilised for transporting Project personnel and goods between the Project area and Port Moresby. It is located adjacent to the Purari River, south of Herd Base. It is currently approximately 1080m x 18m. An upgrade and extension of the airstrip to circa 1,200m x 29m is under review to ensure that the infrastructure meets the Project requirements.
- 9. River dredging:** Dredging of approximately 2 million m³ of the Purari River is required to facilitate safe transport and access for marine vessels, as it will serve as the primary transport and logistics route for all construction activities and materials. Dredging to improve navigability in the river will occur between Herd Base and the Gulf of Papua, including the main channel of the Purari River and part of downstream of the Purivo Junction. Dredging for aggregate recovery will occur upstream and downstream of Hou Creek in the Purari River using backhoe dredging. Aggregate sourced will be transported via the road network. The Purari Riverbed is highly dynamic and due to high levels of sediment deposition it is expected that dredged areas will return to natural contours within 12 months.
- 10. Water extraction:** the Project's L3 Environmental Permit approves water extraction from 23 water extraction points over the 30-year Project period (construction and operation). Water will be extracted for the purposes of hydrotesting, construction, drilling, domestic use, and potable water. The extraction points that will be utilised for the entire 30-year Project period (thus during construction as well as operations) are: Herd Base (camp domestic, process and potable water) and Purari Airstrip (domestic water). The remaining water extraction points are permitted for either single extraction events (e.g. for hydrotest water) or for fixed periods within the Project schedule (e.g. 6 months for domestic and drilling water at Elk-10 wellpad).
- 11. Water discharge:** the Project has identified a total of 22 water discharge locations. The water type being discharged will include grey water, storm water, hydrotest water, industrial wastewater, and drill fluids (discharged at ELK-10, ANT-10 and ANT-11 only). The locations for water discharge that will be utilised across the entire 30-year Project schedule are limited to: Herd Base, CPF, Purari Airstrip and wellpads. All other discharge locations will either be utilised for a single discharge event (e.g. for hydrotest water discharged at trunklines) or for a set period of time within the Project schedule (e.g. 36 months for discharging grey water and storm water at the Herd Base construction camp). Hydrotest water discharge locations are yet to be defined and options may include the Purari River, Orokolo Bay or Caution Bay and the PLEM for the condensate pipeline. The total volume of the offshore export pipelines is 220,000 m³ and the hydrotest water volume is planned to be similar to the pipeline volume. The hydrotest water discharge rate will depend on the dewatering train capacity but would typically be 15 to 23 m³/minute. Consequently, discharge could take six to ten days from one or more discharge lines. Discharge will be undertaken according to applicable requirements.

12. Offshore dumping site: After conducting an analysis to assess the best location for the placement of dredged material, the most suitable location has been determined to be a nearshore location. A nearshore placement keeps the dredged material in the active coastal environment and allows for the dredged material placement to occur via a floating pipeline rather than the need to double-handle material into barges. See Figure 3-1 above for location of the offshore dumping site.

3.1.6 Transport and logistics

Transport will be required throughout the life of the Project, to transfer materials and people. During construction, logistics will be dominated by the movement of large volumes of materials, equipment, fuel, and personnel to PRL-15. Bulk materials, construction modules, pipes, drilling equipment, and aggregates will be transported primarily by sea and river from Port Moresby to the Project area. Onward travel from Herd Base will be primarily by road to worksites. During construction water transport will be the principal mode for freight, using self-propelled barges, landing craft, and flat-top barges to move construction materials, fuel, and equipment via the Purari and Urika-Ivo rivers. Road transport will support quarry material haulage and internal distribution, while air transport will move workers during peak periods using the upgraded Purari Airstrip facilities. The transportation of Project personnel is predicted to peak for the period between 24 months-after- Final Investment Decision (FID) until 41-months-after-FID. Although subject to change, current estimates predict over 85,500 passenger movements of Project personnel across the 5-year construction period, to and from Project sites and key logistics hubs (e.g. Port Moresby).

Once the Project is operational, transport requirements will reduce and focus on maintenance, consumables, fuel, and chemicals. Maintenance materials, diesel, and process chemicals will continue to be delivered mainly by river barges, with storage located at the CPF and Herd Base. Internal road transport will be limited to routine site movements.

During the six-month period of the northwest monsoon (November to April), when sea-state conditions are favourable (i.e. sufficiently calm to allow safe and efficient passage), transshipment operations of large, high-value and motion sensitive equipment, and bulk aggregate, will be undertaken. These will be transported by sea from Port Moresby then transferred to smaller barges closer to the Purari River delta for river navigation.

During the six-month southeast monsoon (i.e., May to October), the prevailing wind and swell directions both approach the Purari River delta from the southeast, creating unsettled sea state conditions in the nearshore zone and at the river mouths, that are unsuitable for ships to anchor or for transshipment operations.

Passengers will be transported by plane, helicopter, boat and car, and during the construction period transport movement will be daily. The highest predicted passenger volume per month is approximately 2,600 passenger movements, occurring in month 39 after FID. A breakdown of construction logistics per vehicle type is provided in Table 3-1.

Table 3-1: Predicted construction logistics per vehicle

Transport Mode	Asset Type	Route Overview	Capacity (if known)	Predicted avg. daily movements (construction)	Notes / Assumptions
Air	ATR 42	Port Moresby to Purari Airstrip	30 pax	3 flights/day	Fixed schedule
Air	Twin Otter	Port Moresby to Purari Airstrip	10 pax	2 flights/day	Feeder flights

Transport Mode	Asset Type	Route Overview	Capacity (if known)	Predicted avg. daily movements (construction)	Notes / Assumptions
Air	H175 / AW139 Helicopter	Offshore	16 pax	1–2 flights/day	Based on monthly utilisation
Air	H145 / Bell 412 (or equiv.) Helicopter	Onshore	~9–12 pax	~1 flight/day	Averaged from 120 h/month
Marine	Passenger ferry boats	Purari River to Port Moresby	15–20 pax	9–12 trips/day	3 boats in rotation
Marine	Passenger ferries (escort / security)	Purari River to Port Moresby	15–20 pax	4–6 trips/day	2 escort vessels
Marine	Passenger ferries (Base Support and Emergency support)	Purari River to Port Moresby	15–20 pax	5–9 trips/day	4 vessels
Marine	LCT (Landing Craft Tank)	Purari River to Port Moresby	N/A	~0.1 trip/day per LCT	8-day round trip
Marine	Cargo barge	Purari River to Port Moresby	N/A	~0.08 trip/day per barge	12-day round trip
Marine	Barge / Multicat vessels	Purari River to Port Moresby	N/A	2 operations/day during peak construction	2 vessels active
Road	Passenger vehicles (cars/minibuses)	Between Herd Base, Purari Airstrip and onshore worksites	8–20 pax	20–40 trips/day	Peak personnel transfer
Road	Special equipment convoys	Onshore	N/A	<1 trip/day	Intermittent

Time of Activities

The planned timing of activities is varied and will also depend on the Engineering, Procurement and Construction (EPC) schedule. Guided by environmental permitting requirements and the Project's E&S impact assessments and mitigation measures, TEP PNG has already determined the following plans:

- Construction of the CPF to occur 24-hours a day.
- Drilling and well operations will also take place on a 24-hour a day basis.
- Rig movement will be undertaken during the daytime only, except for some specific tasks on the wellpads, for which sufficient lighting and safety mitigations would be in place to ensure the safety of the operations.
- Civil works for the Project are also likely to be limited to daytime only.
- Dredging and barging activities are intended to occur primarily during daylight hours, with dredging only extending beyond daylight where constrained by tidal cycles (e.g. at the river mouth), and with vessels generally moored overnight.

Further activity-specific working hours will be decided following engagement with the EPC contractor.

The operation of the Upstream Components (e.g., wellpads, trunklines, flowlines, CPF and export pipelines) will require operations, maintenance and security, and works are anticipated to take place 24 hours per day, 7 days per week.

Workforce Requirements

During the construction phase, the approximate number of workers ranges from 50 people during the initial stages of the early works up to approximately 6,000 people during the peak construction period for both onshore and offshore activities. The different activities include preparatory works, early works, drilling, and site preparation and building of the CPF and pipelines; although not all these activities will take place simultaneously. The workers will be demobilised once their activity is completed.

During the operations phase, the operation of the upstream facilities (e.g., wellpads, trunklines, flowlines, CPF and export pipelines) will require operations, maintenance and security workers. The workforce during operations (production phase) is estimated at approximately 250-300 people. Operations activities are likely to be carried out 24 hours per day, 7 days per week on a rotation basis with 28 days on/28 days off, with all workers living and remaining onsite in the operations camp during their rotation.

Accommodation

A range of accommodation camps will be required during construction and operations to support the workforce. The following table lists out the number of beds planned for each accommodation camp. The “Operation Camp” at Herd Base will remain during the operations phase of the Project. All other camps listed are temporary and are expected to be used during the construction phase only, after which they will be demobilised.

Table 3-2: Details of accommodation camps required during construction and operations

Accommodation Camp	Number of Beds	Location
Operation Camp	300	Herd Base
Early Works and Infrastructure (EWI)	800	Herd Base
CPF	2,500	CPF TCF
Pipeline Camp 1	800	North Herd Base
Pipeline Camp 2	800	Sawmill
Pipeline Camp 3	800	Avai
Purari Airstrip	100	Purari Airstrip
Wellpads/pipelines	400	ANT 3
Drilling	150	ANT 2
Aggregates	150	Hou Creek
Orokolo Bay Pipeline Camp	TBC	Orokolo Bay

An additional 30 to 40 people (approximately) will be accommodated on river boats as part of dredging activities and material transfer during construction.

Disturbance Footprint

To support the Project’s E&S assessments and management activities, the Project’s footprint was assessed in 2025 (Project Footprint Package, Insuco, 2025). The assessment determined that the disturbance footprint of the Project, including onshore and offshore, would total approximately 2,453 ha. Approximately 1,280 ha of the 2,453 ha is planned to be subject to rehabilitation and restoration (primarily through natural

regeneration) post-construction, as Project activities in these areas are planned to be temporary. The EIS Addendum (2024) estimates that of the total Project footprint, approximately 190 ha will be situated on already disturbed land. It is noted that the footprint figures presented in Table 3-3 may differ in places from those presented in the EIS Addendum (2024), this is primarily a result of design changes or optimisation through the FEED process, and the inclusion of additional Project components such as offshore infrastructure.

Table 3-3: Permanent and temporary disturbance footprint

Project Component	Temporary/Permanent	Footprint (Ha)
Wellpads	Permanent	7
Pipelines	Permanent	127
CPF	Permanent	74
Onshore Export Pipeline	Permanent	191.5
Export & Condensate Pipelines	Permanent	477.51
Herd Base	Permanent	28.8
Purari Airstrip	Permanent	61.4
Helipads	Permanent	140
Access Roads & Tracks	Permanent	63.8
Waste Landfill	Permanent	3
Purari River Crossing	Temporary	28.4
Ant 2 Camp	Temporary	0.6
Camps & Warehouses	Temporary	58.1
Material Deposits	Temporary	116.6
Onshore Borrow Pits & Quarries	Temporary	48.8
Temporary River Jetty	Temporary	0.9
Orokolo Bay OpenTrench Crossing	Temporary	7.1
Orokolo Bay Pipeline Camp	Temporary	0.6
Legacy Helipads	Temporary	42.8
River Aggregate Sourcing (Hou Creek)	Temporary	138.8
River Dredging and Waste (Purari River)	Temporary	766.4
Supporting Infrastructure (ANT 3 Camp, Hou Creek Base)	Temporary	25.3
Legacy Areas	Temporary	45.2

Areas were calculated by sequentially intersecting each component footprint with the project master footprint, allocating the intersected area and then removing it from the remaining master so no area could be counted twice. Permanent components were processed first (priority), followed by temporary components; within each group, layers were merged and dissolved to remove internal overlaps before allocation. As a result, totals may differ from simple standalone layer areas because any temporary footprint overlapping a permanent footprint is attributed to the permanent component and is not included in the temporary calculations.

3.2 Project Area of Influence (PAoI)

The Upstream PAoI was initially described within EIS Vol. 1 Ch. 03 Impact Assessment Process & Methods (2019) and was guided by IFC PS 1 (2012) definition of a PAoI, which is the area that is likely to be affected by the Project, by its activities and by facilities that are directly owned, operated or managed by the Upstream Project. This definition includes direct, indirect (or induced), predictable but unplanned, and cumulative impacts arising from the Project.

The EIS (2019) PAoI was delineated utilising E&S criteria, such as terrain features, land and vegetation type, and the affected communities' occupation and use of the land and natural resources, and the potential impacts to these values arising from Project development. The EIS (2019) PAoI was used to define the study areas for each impact assessment discipline. Secondary data sources and the characteristics specific to the discipline were used to inform study area selection and to appropriately characterise the area most likely to be affected by the Project. The study area for each discipline either correlated with or was within the PAoI.

The PAoI defined in EIS (2019) has been reviewed and revised as part of the ESHIA Synthesis to reflect updates arising from the FEED process and an enhanced understanding of impact pathways, E&S connectivity, as well as cumulative effects.

A summary of refinements to the EIS (2019) PAoI can be found below, with a more detailed breakdown in standalone Appendix A. The rationale for adaptations to the cumulative PAoI are further discussed in Section 7 Cumulative Impacts.

The most substantive changes to the PAoI relate to environmental receptors along direct and indirect impact pathways. These changes have been informed by updated design information and impact assessment, due to FEED changes and revised construction methodologies as follows:

- Condensate export pipeline and associated nearshore and offshore corridors
- FSO facility
- Associated marine safety and exclusion zones
- The adoption of HDD at Caution Bay
- Relocation of the CPF
- Updated borrow pit and access track locations.

Additionally, the updated PAoI is also informed by a clearer delineation of river transport and dredging corridors given the findings of the D&B ESIA (2025) and includes legacy disturbance areas associated with historic Project-related exploration activities, as defined in the RIA (2025).

For direct impacts the updated PAoI encompasses areas where negative effects manifest on receptors as a direct consequence of project activities, such as vegetation clearing, earthworks, trenching, and dredging. For certain receptors, the PAoI encompasses areas where impacts are expected to extend beyond the physical footprint (or areas within close proximity) such as air quality, visual amenity, and noise. The direct impact pathways with the greatest spatial extent include a viewshed buffer of 1.5km reflecting landscape & visual impacts of tall CPF infrastructure at surrounding receptors, a 4km nearshore and offshore construction corridor for the export gas and export condensate pipeline, a 1,3km noise propagation buffer around the onshore pipeline route, a 2.5km noise buffer surrounding Orokelo Bay piling locations, a 500m exclusion zone around the FSO, a 200m buffer around all Project component footprints and Project-related land clearings, and the Activity Area of Influence for Dredging and Barging from the D&B ESIA (2025).

For indirect impacts, the updated PAoI encompasses areas where secondary effects that are not caused by the Project's activities themselves occur later in time or farther away as a consequence of those

activities. These may include induced development, changes in land use, increased access to remote areas, or pressures on natural resources and communities caused by project-related growth.

For environmental receptors the indirect PAoI encompasses areas that are influenced, for example, by edge effects, barrier effects, and altered hydrology, but also factors such as increased access and PIIM leading to elevated hunting pressure. This includes terrestrial areas influenced by permanent access roads and pipeline corridors, downstream areas that may be affected by dredging works / sedimentation over time, the Purari and Urika-Ivo transport corridors, and marine areas affected by increased vessel movement. Where these impacted areas have not been fully spatially defined, the geographic boundaries used in the EIS (2019) PAoI have been maintained.

For social receptors the EIS (2019) determined the PAoI using internationally recognised good practice for ESIA's, consistent with IFC PS, Equator Principles, and global SIA methodologies. This involved identifying all Project components and activities, then mapping how these activities interact with people, households, communities, and vulnerable groups. The process includes analysing potential social change drivers such as land acquisition and access restrictions, labour influx, economic shifts, traffic, safety, and environmental impacts with social implications, and identifying pathways through which these may affect social receptors. Administrative and customary boundaries, livelihood zones, access routes, cultural sites, and community infrastructure were incorporated into the analysis, alongside participatory inputs gathered through engagement with affected communities.

The social elements of the PAoI remain largely unchanged from that defined in EIS (2019). The FEED changes listed above do not fundamentally alter the spatial extent of social impact pathways and receptors, nor do they introduce new regional social systems beyond those previously assessed. Refinements to the social aspects of the PAoI are limited for both direct and indirect impacts, and include:

- The inclusion of villages and settlements located along existing direct impact pathways, including riverine communities along the Purari River transport corridor, and settlements near borrow pits and access tracks, and coastal communities affected by both direct and cumulative impact pathways at Orokelo Bay and Caution Bay.
- Inclusion of marine areas where the condensate export pipeline, FSO, PLEM and associated exclusion zones/construction corridors intersect with customary fishing and transport routes.

The ESHIA Synthesis uses a Project-area framework to organise the assessment of social receptors and impact pathways within the PAoI. This framework is described in Section 2.3.3 and is used to explain differences in exposure, sensitivity, engagement requirements, and mitigation across social topics.

As per IFC PS1, the PAoI should also include Associated Facilities and potential E&S impacts arising from the Associated Facilities. Section 3.6 defines Associated Facilities as per IFC PS1 and summarises the Project's approach to identifying them. To date, the FSO is anticipated to become an Associated Facility at some point in the Project timeline, and has been included within the PAoI.

The updated PAoI is illustrated in Figure 3-6 below.

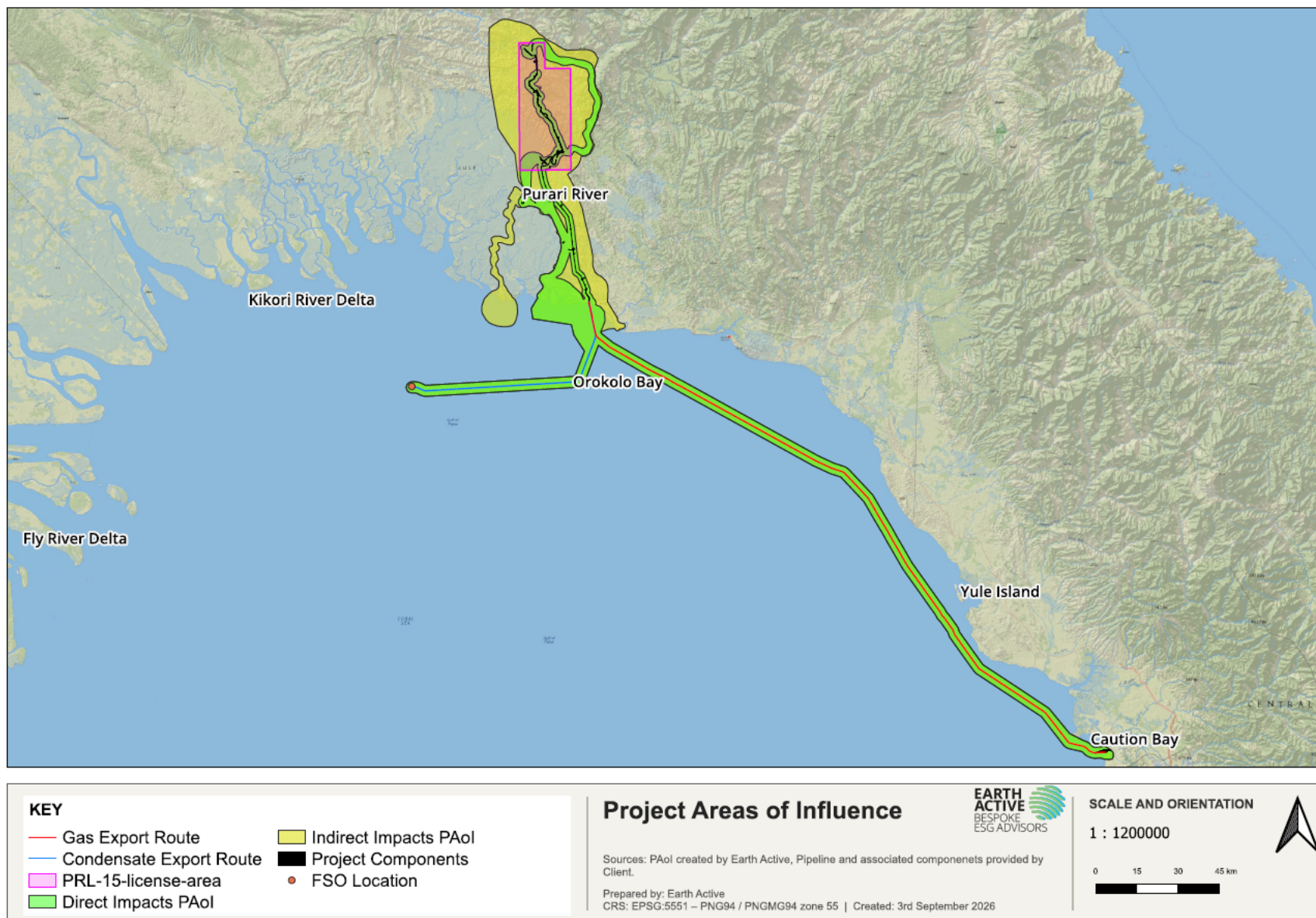


Figure 3-6: Project Areas of Influence (Source: Earth Active Ltd, 2026)

3.3 Project Schedule and Phasing

In line with the L3 Environmental Permit granted by the PNG government, and subject to petroleum licences to be granted by the State at FID, the Project life cycle covers a total of 30 years from the point of FID: 5 years for construction activities and 25 years for operational activities. Figure 3-7 outlines a more detailed timeline per activity type for the construction period, starting from FID. This timeline is accurate as of December 2025 but is indicative only and subject to change.

Activity		Notional Date																			
		Year 1				Year 2				Year 3				Year 4				Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Final Investment Decision (FID)																					
Early Works	Mobilisation																				
	Site works																				
Dredging	Dredging																				
Tree felling	North PRL-15																				
	PER South of Purari River																				
CPF	Detailed engineering and procurement																				
	Construction																				
Drilling	Call for tender																				
	Mobilisation / drilling operations																				
Pipelines	Surveys and engineering																				
	Construction (Onshore and Offshore)																				
FSO	Tentative Hook-Up Date																				
Commissioning commences																					

Figure 3-7: Indicative Project construction timeline from FID (Source: Earth Active, 2026)

The following section provides additional qualitative descriptions of activities per Project phase, as described in the EIS (2019).

Construction Phase

The preparatory and early works period focuses on establishing access, preparing sites, and developing logistics foundations essential for construction. Activities include vegetation clearing for Project roads (R3, R5, R6, and R7) and the Purari Airstrip, clearing and preparing for Herd Base, and conducting environmental, social, land and archaeological Pre-Clearance Surveys (PCS). Early works also involve developing quarries, dredging, tree felling, preparing the CPF and construction camp site, constructing the Purari Airstrip extension, and preparing wellpads (ELK-10, ANT-10, ANT-11). Common early works across all sites include erosion and sediment controls, mobilisation of equipment, grading and excavation, and rehabilitation of temporary disturbance areas.

The construction phase spans approximately five years and includes building all Project infrastructure. Key activities involve CPF construction using modular components transported by barge and assembled onsite (site preparation, civil works, steel and piping, equipment setting, electrical/instrumentation installation, insulation and coating). Construction of Herd Base includes vegetation clearing, bulk earthworks, sheet-pile quay construction, and installation of ramps and offloading facilities. The Purari Airstrip extension requires vegetation clearing, cut and fill operations, hard surfacing, and new buildings. Pipeline installation onshore includes vegetation clearance along the ROW, trenching, pipe laying, backfilling, hydrotesting, and shore crossing works at Orokolo Bay. Offshore pipeline installation uses specialist lay vessels and includes seabed surveys, pipeline laying, and shore approach works. Drilling of development wells at ANT-10, ANT-11 and ELK-10, includes wellpad preparation, rig mobilisation, drilling, well completion and management of cuttings and fluids. Further environmental, social, land and archaeological PCS are also planned for the Construction Phase. Rehabilitation of temporary disturbance areas will also take place during the Construction Phase.

Operations Phase

Operations will include continuous production, processing, transport and maintenance. Key activities include operating and maintaining the CPF (gas separation, processing, gas export compression, condensate stabilisation, acid gas injection, produced water treatment and injection, power generation, utility systems, flares, firewater, and control systems). Pipeline operations involve remote monitoring, periodic pigging and inspections, maintaining cathodic protection, routine surveys (onshore and offshore), and vegetation/erosion management along easements. Well and gathering system operations include routine well surveillance, flowline maintenance and intervention activities. Camps are operated to required safety, hygiene and environmental standards, including waste management and utilities. Energy efficiency measures such as waste-heat recovery, building insulation and optimised heating system are integral to operations. Security operations include monitoring movements along roads, pipeline easements, and wellpads.

Decommissioning Phase

Decommissioning activities will be refined closer to end of field life but are expected to include wells plugging and abandonment, dismantling and removal of above-ground CPF and wellpad facilities, and clearing, cleaning and rehabilitating sites. Pipelines are made safe by purging hydrocarbons, filling with water, capping and abandoning in place, with offshore sections flushed and sealed according to industry practice. Above-ground valve components are removed, and cathodic protection may be retained for future use options. Infrastructure such as roads, Logistics Base and the Purari Airstrip may be dismantled, retained for public use, or rehabilitated. Quarries and spoil areas will be stabilised and restored. Soil contamination surveys and remediation (if needed) will be completed before closure.

3.4 Implementing Entities

The Papua LNG Project Joint Venture partners are:

- TEP PNG (an affiliate of TotalEnergies SE).
- EMPNGA and ExxonMobil PNG Elk Limited (affiliates of Exxon Mobil Corporation (ExxonMobil)).
- Pac LNG Assets Limited, Pac LNG International Limited, Pac LNG Investments Limited, Pac LNG Overseas Limited and Pac LNG Holdings Limited (affiliates of Santos Limited).
- ENEOS Group (previously JX Nippon Oil and Gas Exploration (Papua LNG) Pty Ltd.¹).

The State of PNG has the right under the Oil and Gas Act 1998 to acquire up to a 22.5% participating interest in the Project and its associated development licenses. Should this right be exercised, the current participating interests would be reduced accordingly.

3.5 Analysis of Alternatives

3.5.1 Summary of Analysis of Alternatives

Consideration of project alternatives is a central part of the ESIA process, providing a framework for decision making based on the principles of sustainable development. Section 3.5 summarises the analysis of alternatives the Project has undertaken since the point of Project concept. The Project has continually considered Project options against a range of criteria, including physical constraints, technical feasibility (including cost), health, safety and security, and E&S sensitivity in order to refine and optimise Project design. The Project description, as described in Section 3.1 above, has evolved in line with ongoing assessments of suitability against these criteria.

A preliminary study of Project alternatives was undertaken in 2014 (as described in the EIS (2019)) to consider gas and condensate commercialisation and export options. Following this, a conceptual design phase was undertaken between April 2014 and July 2015 followed by a pre-Project design phase in September 2015 to December 2018.

The concept phase was based on comprehensive screening of concept design options and review of the associated E&S constraints. The no-Project option was also considered at this stage. The Project base case and alternatives were derived and assessed based on baseline surveys, technical studies and risk workshops and according to the criteria provided below in Table 3-4. The methods and approach used for the analysis of alternatives have evolved since the EIS (2019) and assessments have since used different criteria, which are described in the remainder of this section, where relevant.

Table 3-4: Qualitative criteria for assessing options (Source: EIS 2019)

Ranking	Technical or Logistical Difficulty	Environmental Sensitivity	Social Sensitivity
High	Constructability (e.g., risk of flooding or landslides) geohazards, gas processing technology, gas transport parameters, logistical constraints, infrastructure requirements and commercial viability	Potential impacts on sensitive species and ecosystems, topography, landforms and soils, and water resources.	Proximity to population centres, potential impacts on livelihoods and on access to resources and services, cultural heritage, community resilience, immigration, and health and safety risks.
Medium			
Low			

The alternatives considered during the conceptual and Pre-Project phases, as described in the EIS (2019), are summarised in Table 3-5.

Table 3-5: Summary of alternatives considered during the conceptual and pre-Project phases

Design Aspect	Options
Gas commercialisation and Export Options	
Gas commercialisation	- Initial screening of 14 locations for the LNG plant location. - Construct a greenfield plant or extend existing LNG facilities at Caution Bay.
Gas and Condensate Export	- Use existing condensate export terminals at Kutubu. - Construct a greenfield export terminal closer to PRL-15. - Utilise a single pipeline for gas and condensate. - Transport condensate by barge down the Purari River. - Export gas and condensate through onshore pipelines rather than a combination of onshore and offshore pipelines. - Export condensate to FSO and LNG to Caution Bay.
Location and Layout	
CPF location	- Six site locations initially screened. - Two site locations assessed in detail.
Wellpads and gathering station layout and location	- Develop new wellpads. - Re-use existing wellpads and wells. - Group wells on each wellpad. - Collocate wellpads and gathering station.
Logistics facilities	- Develop a new logistics base. - Upgrade and use Herd Base as the logistics base throughout the Project life. - Upgrade and use Herd Base for early works and develop and use a new logistics base for construction and operations.
Pipeline Routing	
Gathering network	- Initial screening of several alignment options for both flowlines and trunklines. - Re-use and upgrade existing tracks or roads ROW. - Optimise the pipeline trench through collocation of pipelines (e.g., production, water injection).
Onshore export pipeline routing	- Fully onshore alignment from the CPF to Caution Bay. - Purari River route from the CPF to Orokolo Bay. - CPF to shore crossing route options. - Several alignment options at the Orokolo Bay shore crossing. - Alignment options for the Purari River crossing.
Offshore pipeline routing	- Several alignment options from Orokolo Bay to Caution Bay avoiding sensitive areas. - Landfall options at Caution Bay to avoid sensitive areas.
Process and Technology	
Acid gas management	- Acid gas injection into the Antelope Reservoir and/or Elk Reservoir. - Acid gas incineration. - SO₂ venting to the atmosphere. - Solid sulphur landfill disposal. - Conversion of sulphur in liquid form for injection with water.
Produced water management	- Treatment using reed bed technology. - Discharge to soils/irrigation after treatment. - Use solar and/or mechanical evaporation. - Dilution during upset conditions prior to discharge. - Discharge to the sea at Orokolo Bay or Caution Bay. - Discharge to the Purari River. - Reinjection into the Antelope Reservoir.
Construction	

Design Aspect	Options
Aggregate (quarries and borrow pits) sourcing and quarry locations	• Transport aggregates by road and barge from Port Moresby. • Re-use materials from onsite excavations (e.g., for the CPF, roads). • Re-use materials from rivers dredging. • Establish new quarries (various options).
Pipeline construction techniques (river crossings and shore crossing)	• HDD. • Micro-tunnelling. • Direct pipe. • Bridge. • Open trenching.
Transport and Logistics	
Airfield design and location	• Upgrade the existing Purari Airstrip to an International Civil Aviation Organization (ICAO) Code 2 runway (over 800m but less than 1,200m in length) • Develop a new (Code 2) airstrip north of the Purari River. • Develop a smaller new (Code 1) airstrip north of the Purari River and use the existing Purari Airstrip during construction.
Water transport routes	• Wame-Varoi River. • Uriko-Ivo River. • Purari River.

Since 2019, further optimisation of the Project 'base case' has continued through the Project's FEED and detailed design phases. Avoiding and minimising E&S impacts based on qualitative criteria was integral in the identification of alternatives during the Project's conceptual and pre-Project design phases.

Assessment criteria have been used in all Project alternatives assessments. Different criteria are used in the separate reports to reflect the subject matter and context. However, in all cases, a range of environmental, social, physical, technical factors, and commercial feasibility are considered using a systematic method. The design optimisation process followed the mitigation hierarchy approach in-line with the IFC PS:

- Avoidance
- Minimisation
- Rehabilitation or restoration
- Offset or compensation.

Several design optimisations during FEED reduce and redistribute overall Project footprint. As per the FEED Changes EAR (2025), major reductions in footprint include:

- Shortening the export gas pipeline from 260 km to 258 km and the condensate export pipeline from 320 km to 156 km, the latter achieved by rerouting condensate export to the third-party FSO, eliminating the need for a CALM buoy and associated nearshore infrastructure at Caution Bay.
- The shift from trenching to horizontal directional drilling (HDD) at Caution Bay removes seabed disturbance to sensitive habitats, avoiding the coral and seagrass impacts previously assessed in 2019.

Conversely, the FEED process introduced new onshore disturbance through the development of five borrow pits, with a combined direct footprint of approximately 32 ha (Elk-2: 7 ha; KP9: 4 ha; KP30, KP54 and KP60: 7 ha each), plus associated access tracks, bringing total borrow-pit related disturbance to roughly 38 ha. Dredging requirements in the Purari River increased from three to 11 locations, representing a notable expansion of in-river construction activity; dredge volumes at new sites range from 500 m³ to 450,080 m³, depending on location.

Overall, while the FEED changes introduce modest new terrestrial disturbance (primarily ~7 ha of new primary forest at KP54), they largely reduce offshore and nearshore footprint via shorter pipelines, lower hydrotest-water volumes, and removal of Caution Bay marine structures, resulting in a net shift toward a lower impact Project design.

The following sub-sections provide more detail regarding the analysis of alternatives per key Project components, and how that has resulted in design change and optimisation in the FEED process.

3.5.2 Gas Commercialisation, Export and Export Options

Gas Commercialisation

During the early Project phases, screening studies to identify a recommended LNG plant location considered fourteen locations. Six were selected for further analysis, and E&S screening was undertaken on these sites (Table 3-6) see criteria provided in Table 3-4.

Table 3-6: LNG plant location and E&S screening results

Aspect	Caution Bay	Ala-Ala	Obu Plantation	Cape Possession	Oiapu	Cape Cupola
Social Assessment						
Resettlement	Low	Med	High	High	High	Low
Land ownership	Low	High	Med	Low	Med	Med
In-migration	Med	High	Med	Med	Med	High
Cultural heritage	High	High	Low	Low	Med	Low
Livelihood	Low	Low	High	High	Low	Low
Community resilience	Med	High	Med	Med	Med	High
Community sensitivity	Low	High	High	High	High	High
Environmental Assessment						
Landform and soils	Low	Low	Low	Low	High	High
Water resources	Med	Low	Low	Low	Med	Med
Terrestrial biodiversity	Low	High	Low	Low	Low	High
Marine environment	Med	Med	Med	Med	Med	Med
Fisheries and shipping	Med	Med	Med	Med	Med	Med

The location south of the existing PNG LNG Facilities at Caution Bay was assessed during early Project phases as having several medium E&S sensitivities, and high cultural heritage values impacts which could be managed appropriately through standard construction practices and suitable community engagement. Once Caution Bay was selected as the preferred site, two concepts were considered for its development:

- Construction of a greenfield standalone plant
- Integration with the existing PNG LNG Facilities in Caution Bay.

TEP PNG and ExxonMobil began discussing adding gas processing facilities at the existing PNG LNG plant site in 2017. Integration of the Papua LNG Project downstream LNG facilities with the existing PNG LNG Facilities was chosen as the preferred option, subject to a suitable commercial arrangement. Additional trains to be constructed will use the spare capacity of the existing utility, storage and loading facilities, and existing common facilities can be expanded as needed to meet additional requirements of the expanded facility.

Process and Technology - Gas Treatment

The gas produced from the Elk-Antelope Reservoirs contains native CO₂ and hydrogen sulphide (H₂S) and is referred to as acid gas. It must be removed prior to liquefaction to achieve the technical and commercial specification of less than 45 ppm for CO₂ and less than 3 ppm for H₂S.

The options for treatment of the gas considered in the EIS (2019) Project description were as follows:

- Incineration via a thermal oxidiser
- Reinjection into Antelope Reservoir and, or Elk Reservoir.

The EIS (2019) presented an acid gas management strategy that involved partial reinjection into the Elk Reservoir. This concept comprised incineration of acid gas via a thermal oxidizer followed by sulphur recovery (desulfurization) prior to release of the gas via a conventional stack. Once the Elk Reservoir was depleted, after approximately 4 years of production, acid gas would be reinjected into the reservoir. The thermal oxidizer and flue gas desulfurization processes would remain on standby, ready to operate at short notice so that acid gas could be treated if acid gas reinjection was not possible.

Venting of SO₂ to the atmosphere and solid sulphur disposal brings in risks to the environment & human health receptors, and practical disadvantages. Flue gas desulfurization, however, is a practical solution if the liquid effluent is injected with produced water into the Antelope Reservoir at ANT-11.

The options have been revisited as part of 2025 FEED design optimisation. The preferred solution for acid gas disposal is to reinject into the Antelope Reservoir at the commencement of operations. Once the Elk Reservoir is depleted, Elk Reservoir will act as the main acid gas storage. During Elk Reservoir depletion the acid gas is returned to the Antelope gas field through a dedicated 10" line and reinjected into Antelope Reservoir via a new well drilled from the existing ANT- 4 wellpad. The initial injection into the Antelope Reservoir leads to a possible acid gas recycling which is mitigated through AGRU design.

If acid gas reinjection is not available, acid gas will be processed via a gas-assisted acid gas flare rather than the thermal oxidizer and flue gas desulfurization process. The gas-assisted flare is preferred as:

- It is simpler, i.e., there is less chance of it failing and requiring repairs/maintenance.
- Modelling has demonstrated that sulphur emissions will be compliant with Project criteria.
- There are greater process efficiencies and hence a lower cost.
- It eliminates the need for continuous fuel gas burning by standby thermal oxidizer.

The benefit of the revised strategy is a large reduction in the amount of acid gas released to the atmosphere during the first four years of production, i.e., the 5 to 20% of the acid gas that would not be burnt in the incineration process released to the atmosphere.

Many of these changes achieve a reduction in Project footprint or an improvement in environmental performance.

Produced Water

The feasibility of injecting the CPF liquid effluent mixed with water, and the treatment required for both injection and discharge of both produced and process water, was evaluated as part of the EIS (2019). The study examined the following options:

- **Option 1:** Reed bed treatment technology is not considered to be proven and has a perceived lack of benefit compared with conventional biological treatment.
- **Option 2:** Discharge on soils or irrigation is only recommended for very low water flow rates and when there is no river or sea nearby for disposal.
- **Option 3:** Solar or mechanical evaporation is unlikely to be feasible in PNG, given the rainfall rate is much higher than the evaporation rate. Further, an additional surface area of approximately 600m by 300m at the CPF or 500m by 300m at the LNG plant would be required to install evaporation ponds, resulting in greater vegetation clearing.

- **Option 4:** Dilution during upset conditions involves the use of surface water in open drainage lines to dilute treated produced water, prior to discharge. TEP PNG considers this option to be unacceptable even during downgraded situations.
- **Option 5:** Discharge to the sea would require additional pipelines and a costly water treatment plant to be installed so that discharged water can meet water quality specifications.
- **Option 6:** Discharge to the Purari River would require a costly water treatment plant to be installed so that discharged water can meet water quality specifications.
- **Option 7:** Full reinjection minimises the potential negative effects on freshwater and marine receiving environments, and on the PACs that use the river for drinking water and both the river and the sea for fishing and transportation.

Reinjection of all produced and process water, i.e., Option 7, was therefore adopted as the preferred option for normal operations. The Project proposes to reuse an appraisal-phase wellpad for water injection and collocating the water injection pipeline in the same trench as the trunklines for much of its length.

3.5.3 CPF Location and Layout

As per the EIS (2019), several locations were considered for the CPF during the conceptual phase of Project development, including sites near the wellpads, on the Kuku creek near Herd Base, and near the Purari River. These locations were evaluated based on the requirements for clearing and engineered fill material, and the potential need to build or upgrade roads to allow heavy equipment access, especially during construction.

Since completion of the EIS (2019), TEP PNG has investigated alternative locations for the CPF to avoid siting in primary (unlogged) alluvial and hill forest. Logged forest was identified as a preferred location for the CPF as the logged areas have lower biodiversity value and therefore disturbance in this forest would reduce the net requirement for biodiversity offsets associated with the Project.

The specific objective of the assessment was to identify whether there are locations additional to the originally proposed CPF location (site P2C) that present a lower environmental and/or social risk, while still being technically and commercially viable. Nine potential CPF locations (known as sites SP1 to SP9) were identified south of the Purari River based on elevation and vegetation condition (preferencing sites that were identified through remote sensing data as likely to contain degraded/logged forest). A potential alternate location north of the Purari River (site P3), being the area of the current gravel pit to the west of Herd Base, was also identified. While reviewing aggregate sources for the Project, the infrastructure engineering contractor identified this site as not only a suitable borrow pit for construction but also as potentially an area for an alternate CPF platform. Figure 3-8 presents the alternative locations for the CPF that were assessed.



Figure 3-8: CPF Locations Assessed (Source: Alternatives Assessment, 2023)

The EIS Addendum (2024) describes the criteria used to assess the different CPF locations, which had evolved from the criteria used in the EIS (2019). The criteria considered:

- Physical constraints (soil type, terrain/slope stability, geohazards, flooding/drainage). Executability/technical feasibility (constructability, cost and commercial viability regulation, company reputation, operability/complexity of operations, development flexibility, logistics/spread of operation).
- Health safety and security (security, workforce health and safety, community health and safety).
- Environmental sensitivity (protected areas, sensitive ecosystems of habitats, vegetation condition, priority species, acid sulphate soils, water resources, GHG emissions, cumulative impacts)
- Social sensitivity (land ownership, risk of in-migration, land and water use, physical displacement, economic displacement, amenity, cultural heritage stakeholder acceptability).

A qualitative assessment of the 'suitability' of each option was made across each criterion. Rankings for suitability were also further developed from the 'low, medium and high suitability' classifications used in the EIS (2019). Rankings for suitability were assigned based on the colour system and descriptors shown in Table 3-7.

Table 3-7: Key to suitable categories

Colour Coding	Suitability
	No go. Unacceptable environmental or social impacts that cannot be satisfactorily mitigated. Technically infeasible, economically unviable, substantial reputational damage.
	To be avoided wherever possible. If not possible, significant mitigation will be required, e.g., biodiversity offsets, compensation programs, substantial engineering features, and/or substantial costs and risks involved.
	Not without environmental/social impacts or engineering/economic/regulatory risks, but these can be readily managed to an acceptable level.
	Minimal environmental/social impacts and/or low engineering/economic/regulatory risk.
	Further studies/information are required to address major uncertainties in the assessment.
X	Information is not available to complete the assessment.

As the EIS Addendum (2024) describes, many technical and geophysical constraints were encountered when reviewing these alternative sites which made 7 of the 10 alternative locations 'No-go' due to proximity to faults, influence from flooding and safety distance to the Purari Airstrip. Three alternate locations were deemed as potential sites, being sites SP5 and SP9, both south of the Purari River, and site P3, north of the Purari River. The 'suitability' rankings for these three sites and base case site P2C are shown in Table 3-8.

Table 3-8: CPF site suitability rankings

Criteria	P2C	SP5	P3	SP9
Physical Constraints				
Soil type				
Terrain/slope stability				
Geohazards				

Criteria	P2C	SP5	P3	SP9
Flooding/drainage				
Executability/Technical Feasibility				
Constructability				
Cost and commercial viability				
Regulation				
Company reputation				
Operability/complexity of operations				
Development flexibility				
Logistics/spread of operations				
Health, Safety and Security				
Security				
Workforce health and safety				
Community health and safety				
Environmental Sensitivity				
Protected areas				
Sensitive ecosystems or habitat				
Vegetation condition				
Priority species				
Acid sulphate soils (ASS)				
Water resources				
Greenhouse gas emissions				
Cumulative impacts	X	X	X	X
Social Sensitivity				
Land ownership				
Risk of in-migration				
Land and water use				
Physical displacement				
Economic displacement				
Amenity				
Cultural heritage				
Stakeholder acceptability				

These sites were assessed for viability which resulted in site SP9 being deemed 'No-go' due to geophysical and execution risks. Of the remaining two viable sites, P3 was preferred. Following the above assessment,

the CPF was therefore relocated from the 'P2C' site to the 'P3' site, located adjacent to the Purari River, and approximately 29km south of the ANT-10 wellpad and 40km from the ELK-10 wellpad. It will be approximately 1km southwest of Herd Base (as seen in Section 3.1). The main drivers for relocation, as summarised in Table 3-9, were better soil characteristics thus requiring simpler preparation works, and easy access to the river as well as shorter distance to Herd Base, that would ease logistics and operations during construction and production phases.

Table 3-9: Summary of changes in CPF location

Project Infrastructure	Upstream EIS	EIS Addendum
CPF location	P2C	P3
NLB	West of Herd Base and south of CPF P2C to be used for construction and operations	Not required. Logistics to operate from Herd Base expansion. Construction offloading occurs at the MOF and the COF at CPF P3
Roads	Road R01 Road R02 Road R04	Not required Not required Halved in length and name changed to Road R03
Operations camp	Part of CPF P2C	Existing Herd Base expansion
Trunkline/export pipeline	Export pipeline trenchless crossing east of NLB	Realignment of pipeline to/from CPF P3. Export pipeline trenchless crossing approximately 1 km upstream of the original crossing location

Both P2 and P3 are in dense forest identified as Critical Habitat. It is estimated that by relocating the CPF from P2C to P3, the loss of approximately 40 ha of forest will be avoided (EIS Addendum (2024)).

Changes associated with the relocation of the CPF also include:

- Locating the logistics facilities at Herd Base rather than development of the New Logistics Base (NLB).
- Minor rerouting of the export pipeline in the vicinity of the CPF's new location.

3.5.4 WellPads and Gathering Stations

At the end of the conceptual design phase, up to eight wellpads were identified as being necessary to develop the reservoirs. Appraisal drilling data showed that optimising the number of wellpads was possible. Consequently, the Antelope production wells were planned to be grouped on a single wellpad, reducing the disturbance footprint from pads and interconnecting pipelines.

Following 2024 FEED design refinement it is planned to reuse two appraisal wellpads for the new production (ELK-10, formerly Elk-1) and water reinjection (ANT-11, formerly ANT-4) wells. The Antelope field will be developed with 7 gas producing wells on ANT-10 as stated in EIS (2019). Grouping wells and reusing existing wellpads has reduced the overall wellpad disturbance footprint. The footprint of ANT-10 was decreased by 2 ha following FEED (EIS Addendum 2024).

A separate gas gathering station, was initially planned. However, with the improved reservoir knowledge enabling the single wellpad for Antelope Reservoir, it was decided to locate the gathering station at the Antelope production wellpad (ANT-10), thus further reducing the overall footprint and minimising vegetation clearing and ground disturbance.

3.5.5 Logistics Facilities

Herd Base is the existing logistics base in PRL-15 and was used during appraisal drilling. The Kuku Ridge separates it from the CPF location, and access between the two requires the existing track, which has several steep sections, to be upgraded. These steep sections require extensive grading, levelling, and realignment to meet the increased traffic density and heavy haul requirements of the CPF equipment (e.g., up to 1,000 tonnes and large modules).

Herd Base is also physically constrained in its expansion capacity beyond its existing footprint to meet the Projected construction personnel requirements and is at risk of inundation at the quay level. The following three options were assessed for their capacity to meet the construction and operations logistics needs because of these limitations:

- **Option 1:** develop a new logistics base of approximately 20 ha on the northern bank of the Purari River, approximately 5km downstream from Herd Base, and construct an approximate 2.6km, flat, heavy transport road to the CPF.
- **Option 2:** upgrade and expand the existing facilities at Herd Base (to be used as a logistics base for the duration of the Project) and construct an approximate 5km, steeper, heavy transport road to the CPF.
- **Option 3:** upgrade and use Herd Base for early works with the construction of a 'light-duty road, using the existing track, to support initial mobilisation and the development drilling campaign, then develop a smaller, approximate 7ha, new logistics base and a 2.6km heavy haul road to the CPF at a later stage.

These options were developed based on the logistics sequences of early works, Project construction and Project operation. As captured in the EIS Addendum (2024), Option 3 has been selected as the preferred option because it enables early mobilisation of personnel and equipment to begin the construction of Project infrastructure, which better meets the Project timeline. Further changes were made to the logistics base following the decision to relocate the CPF. Currently the plan is to construct the logistics base within the extended Herd Base along with the operation camp. A standard road (R3) connects Herd Base to the CPF, the Heavy Haul Road is constructed between the MOF and the CPF.

3.5.6 Pipeline Routing

Gathering network

The gathering network initially comprised two 22-inch trunklines connecting the Antelope production wellpad (ANT-10) to the CPF, and a single 14-inch flowline connecting the Elk production wellpad (ELK10) to the CPF. It was further optimised so that ELK10 production was transported to ANT10, with three alignments assessed for the Elk production flowline routing; the western, central and eastern routes. The routing considered several constraints, including swampy areas, fault crossings and landslides, river crossings, slopes, environmentally sensitive forest areas, soil conditions, the availability of aggregates and accessibility for construction (See Figure 3-9).



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Figure 3-9: Pipeline alternatives considered (Source: EIS Vol. 1 Ch. 05 Project Options & Alternatives Analysis (2019))

As a result of the analyses, the central route was selected as the preferred option. The main reasons for this choice were:

- The alignment minimises the length to limit pressure drops, enabling a free-flow CPF design.
- Combining the access road and the pipeline ROW reduces the vegetation clearing and earth disturbance footprint.
- Construction and maintenance will be easier due to the pipeline ROW running parallel to the road.
- The environmentally sensitive alluvial forest south of the Kuku Ridge was avoided.
- The Pie River catchment, which is remote, relatively untouched by development and identified as a high priority for avoidance due to the upstream terrestrial biodiversity baseline study (EIS, 2019) and the possibility of increasing the number of affected communities downstream of pipeline works, was avoided.

The Elk production will now be sent to the Antelope manifold through two 14" trunklines then to the CPF via Antelope 22" trunklines. Elk fluid will be recompressed using an ejector installed at ANT-10 to ensure sufficient depletion of Elk Reservoir prior to its conversion into acid gas storage. This is now the preferred design.

In addition, optimising the pipeline trench design allowed collocation of the four pipelines (i.e. two production, one water injection, one acid gas injection pipelines and one water injection pipeline) south of ANT-10 and the electric and fibre optics cables in only two trenches, decreasing the width of the pipeline ROW.

Onshore Export Pipelines

The original 2019 plans for the main export pipeline design comprised separate gas and condensate pipelines connecting the CPF to the downstream LNG plant. Two onshore routes considered early in the design process (the 'overland' and Purari River options) were discarded due to environmental, social, logistical and safety constraints.

The Project subsequently considered laying the pipelines from the CPF to the Gulf of Papua coast, where they would connect to offshore pipelines. This approach would minimise the footprint clearing, the social implications, and the engineering challenges of onshore routing.

As discussed in the EIS (2019), assessing these options began with identifying a western alignment to Orokolo Bay and a central alignment crossing the Vailala River and up to the Bluff coastline which were ranked for E&S sensitivities, pipeline constructability, and environmental (e.g., flooding, geophysical) constraints. This study determined that the western alignment to Orokolo Bay was preferred, due to the lower risk of landslides, much shorter onshore section (i.e., 60km compared to 94km) and therefore smaller onshore footprint. While the northern part of the western alignment largely followed an existing logging trail to minimise the disturbance footprint, the coastline south of the alignment features villages, marshes (including mangroves) and cultural sites, resulting in a risk of increased adverse impact on communities and the environment.

A buffer was applied around the western alignment to support the assessment of E&S sensitivities. Constraints mapping was undertaken to optimise the corridor in the southern section from the village of Kilave to the coast at Orokolo Bay where the corridor was narrowed further. The area mapped and characterised during the E&S baseline surveys coincided with this refined export pipeline corridor, extending from approximately 2km west of the village of Harevava, in the west of Orokolo Bay, to the village of Hororo in the east.

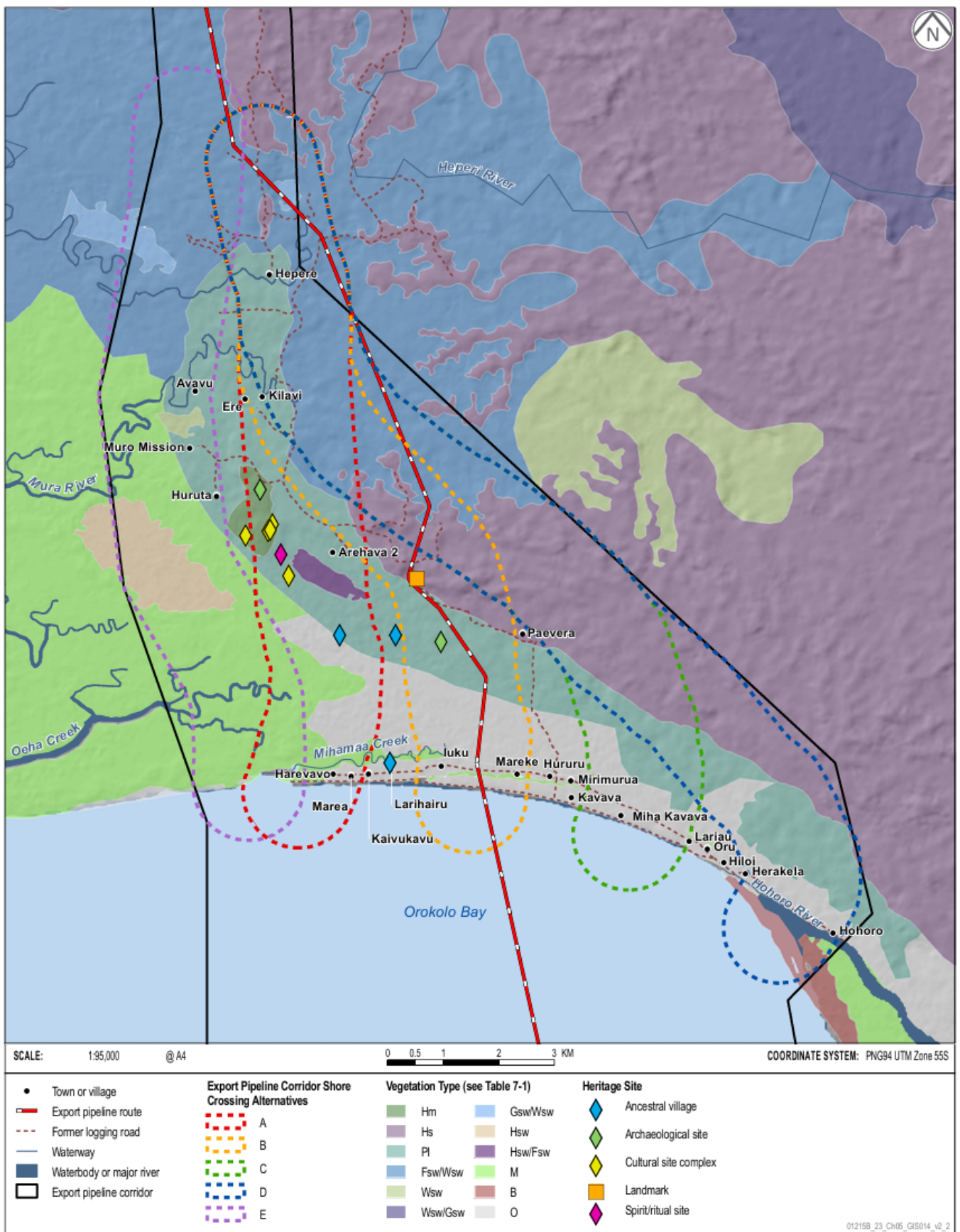
Five potential alignments, (A to E, see Table 3-10 and Figure 3-9) in this corridor were ranked according to their E&S sensitivity to determine the most appropriate shore crossing location for the pipelines Table 3-10 (see Table 3-4 for criteria).

Table 3-10: Onshore export pipeline shore crossing alternatives analysis summary

Criteria	A	B	C	D	E
Technical or logistical difficulty	Low	Low	Low	Med	Low
Environmental sensitivity	High	Low	Low	Low	High
Social sensitivity	Med	Med	High	Med	Med

This assessment concluded that corridor B, passing between the villages of luku and Mareke, was the most suitable alignment. E&S sensitivities are still present in corridor B, but this corridor is likely to cause the fewest potential adverse social, cultural and environmental impacts, provided cultural sites can be avoided and subject to PCS.

The FEED Changes EAR (2025) describes further changes made to the design of the onshore export pipeline routes, to account for Purari River crossing considering CPF relocation at P3 site, and alignment to cross the Mayur lease.



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Figure 3-10: Export pipeline onshore route 2019 options (Source: EIS, 2019)

Offshore Export Pipelines

The originally proposed offshore export pipelines route extends for approximately 260km from Orokolo Bay to the PNG LNG Facilities in Caution Bay. Route selection for the offshore pipelines was informed by the following criteria:

- Selecting an appropriate site for the LNG facilities.
- Identifying the shore crossing in Orokolo Bay and Caution Bay.
- Minimising potential impact on customary land and community livelihoods activities.
- Optimizing the pipeline length to be as short as practicable.
- Maintaining a minimum distance of 100m between the PNG LNG Gas Pipeline and the Project pipelines.
- Maintaining the crossing angle of the existing PNG LNG Gas Pipeline at between 60° and 90°.
- Minimising the pipeline depth as much as practicable.

Seven offshore route options were studied in 2017 to assess how well they met these design criteria. The option finally selected minimised pipeline length, avoided geohazards and used the existing PNG LNG pipeline corridor as much as possible.

From the EIS (2019), the preferred option was to pipe the condensate to the existing PNG LNG Facilities at Caution Bay. Optimizing gas and condensate export pipelines into one multiphase (i.e., gas and condensate) pipeline was evaluated. The two-pipeline option was chosen based on the following operational and environmental benefits:

- Less vegetation clearing required at the CPF departure when gas and condensate are separated.
- Gas and condensate are less volatile when exported in separate pipelines.
- The reduced volatility requires a smaller exclusion zone around the pipelines, which requires less vegetation clearing.
- The absence or the reduction of compression requirements when condensate is separated from gas before transport, generating fewer greenhouse gas emissions.
- The possibility to operate at lower flowrates than those allowed by multiphase transportation.
- Laying the two pipelines in parallel, which does not affect significantly the construction ROW width, as the two pipelines can be laid in the same trench.

During the 2025 FEED there was a major change in design of the condensate line as it was decided to export the condensate to a third-party FSO facility in the Gulf of Papua. A condensate pipeline (10-inch diameter) will be used (ca. 90 km offshore) to transport the condensate production from the CPF to an FSO.

The condensate pipeline will be laid in the same trench as the gas pipeline from the CPF to the shore crossing at Orokolo Bay. The condensate pipeline will continue south until it intersects with the PNG LNG Gas Pipeline. From that point, the condensate pipeline will run west, alongside to the PNG LNG gas pipeline until it reaches the FSO. At the FSO, the Papua LNG condensate pipeline will terminate at a Papua PLEM with a riser connecting the PLEM to the FSO. The battery limit of the Papua LNG infrastructure is at the downstream flange of the riser. The FEED Changes EAR (2025) describes further changes made to the design of the offshore gas export pipeline:

- Nearshore:
 - o Change to construction methodology at Caution Bay with HDD now being the base case

- o Change route at Caution Bay landfall to the north of the existing jetty to account for change in construction methodology, now being the base case.
- Offshore:
 - o New alignment to east of existing PNG LNG route to prevent multiple crossings of this pipeline now being the base case.

The 2025 FEED design changes described above will result in a reduction in the length of pipeline required by the Project by 164 km. It will also result in a reduction in the volume of hydrotest water. However, as per the FEED Changes EAR (2025) these design changes for the condensate pipeline are not anticipated to result in material changes to Project E&S impacts.

3.5.7 Construction

Quarries and Borrow Pits

Several studies have been undertaken to identify aggregate sources capable of meeting the Project's construction requirements within and beyond PRL-15.

The alternatives assessment considered a range of potential aggregate supply options capable of providing the quantity and quality of material required for Project construction. The assessment was undertaken in accordance with the Project's alternatives assessment framework and considered technical, environmental, social, biodiversity, cultural heritage, logistical and commercial factors relevant to each option.

Potential aggregate sources were initially screened to confirm technical feasibility and the availability of sufficient suitable material. Options that did not satisfy those requirements were excluded from further consideration. The remaining feasible options were then subjected to a comparative multi-criteria assessment. These included aggregate extraction from:

- The Purari River near Hou Creek
- Nebiri Quarry
- Boa Creek
- Aure Scarp Quarry
- Northeast Poroï 2
- Kido Quarry
- Chinese Harbour Engineering Company (CHEC) quarry supply
- International aggregate supply options.

The comparative assessment was undertaken using a multi-criteria evaluation framework. Assessment criteria were grouped into the following categories:

- Physical constraints
- Executability and technical feasibility
- Cost and commercial viability
- E&S criteria aligned with the IFC PSSs, including:
 - o Assessment and management of E&S risks and impacts
 - o Labour and working conditions
 - o Resource efficiency and pollution prevention

- o Community health, safety and security
- o Land acquisition and involuntary resettlement
- o Biodiversity conservation and sustainable management of living natural resources
- o Indigenous Peoples
- o Cultural heritage.

Each option was assessed against the applicable criteria using a consistent rating system, with consideration of available technical studies, E&S baseline information, biodiversity data, cultural heritage information, permitting requirements, implementation constraints, logistics and commercial factors. Assessment outcomes were combined using a weighted scoring approach to enable comparison of alternatives on a consistent basis and to assist in identifying the option that provided the most favourable overall balance of technical feasibility, environmental and social performance and commercial practicality.

Table 3-11 below shows the ranking for each of the alternatives assessed.

Table 3-11: Summary of aggregate sourcing alternatives assessment

Potential aggregate source	Final rank
Nebiri	2
Aure Scarp	8
NE Poroi 2	5
Hou Creek	1
Boa Creek	4
Kido	3
CHEC	6
International	7

The assessment identified aggregate extraction from the Purari River near Hou Creek as the preferred option. While E&S risks were identified for all feasible alternatives, the Hou Creek option achieved the most favourable overall outcome when considering material availability, constructability, logistics, environmental and social impacts, biodiversity and cultural heritage constraints, and commercial viability. The option performed particularly well against PS2 (labour and working conditions) and PS3 (resource efficiency and pollution prevention) and benefits from a substantial available aggregate resource, proximity to key construction areas, relatively simple extraction methods, reduced transportation requirements and lower overall costs compared with many alternative sources. Although biodiversity, cultural heritage and community-related risks were identified, these were assessed as manageable through the application of the mitigation hierarchy and Project-specific management measures.

In contrast, alternative options were generally constrained by combinations of higher capital and operating costs, greater logistical complexity, constructability challenges, land access and permitting requirements, biodiversity sensitivities, cultural heritage considerations, or uncertainty regarding resource availability and operational feasibility. The weighted assessment therefore demonstrated that the Hou Creek option provided the most favourable balance of technical, environmental, social and commercial considerations.

Construction, River and Shore Crossing

Constructing the export pipelines will require crossing the Purari River and several small streams. Several different options for constructing the Purari River crossing were studied during the pre-Project phase, including HDD, micro-tunnelling, direct piping and a bridge.

Three routes across the Purari River were evaluated for their suitability for HDD construction. The eastern and western routes were discounted due to a low-lying, muddy entry platform required for the eastern route and the longer length of HDD required for both. The central route was chosen as the preferred route because of the gravel material available on the hills above the Purari River, which will provide a good platform with adequate drainage for construction, and because it is the shortest route. Trenchless approaches under consideration today for Purari River crossing include HDD, direct pipe and micro-tunnelling). The best approach will be defined during detailed engineering.

For the Orokolo Bay shore crossing a number of options have been considered, including, HDD, micro-tunnelling, direct pipe, open trench, and post-trench construction methods. FEED and FEED-update work (2022–2025), including a Danish Hydraulic Institute (DHI) burial risk study (Pipeline Shore Approach Assessment, 2024¹), provided better information on required burial depths and natural backfilling. The updated design therefore shifted to a hybrid solution, a short 100 m coffer dam and conventional trenching close to shore, followed by post-trenching once sufficient water depth and seabed conditions made that practical.

Post-trenching was ultimately chosen for the Orokolo bay shore crossing because it achieved the Project's burial requirements while substantially reducing physical disturbance, construction complexity and schedule. By laying the pipeline on the seabed and then using a plough to achieve 1 m cover over most of the nearshore section, the design reduced coffer dam length from 800 m to 100 m, dredging volume from about 1.8 million m³ to about 335,000 m³, and installation period from roughly six months to three months. It also removed the need for a temporary jetty and, with the diameter reduction from 40" to 30", eliminated the earlier requirement for long sections of burial in the lobster migration route.

The Orokolo Bay Nearshore Crossing Methodology (2025) (hereafter referred to as Orokolo Bay Memo, 2025)) also embeds community access and livelihood-protection controls into the design and tender information. These include:

- Maintaining designated community crossing locations during construction
- Maintaining pedestrian access at all times where practicable
- Using traffic controllers/spotters during intensive works
- Providing a temporary bridge across the trench
- Constructing a pedestrian bridge along the beach to maintain east-west beach access
- Constructing a walkway around the northern perimeter of the shore-pull construction compound
- Water-related controls include maintaining flows at waterway crossings, installing erosion and sediment controls, monitoring water quality upstream and downstream before, during and after crossing works, and confirming that water quality returns to baseline levels following completion of the works.

Transport and Logistics

Three high level options for transport of personnel to the site from Port Moresby, road, fast crew vessel and air transport. Road and fast crew vessel were impractical and discounted leaving air transport as the preferred option. Further refinement of the air transport option was considered as follows:

¹ Cited but unseen by Earth Active

- **Option 1:** Develop a new 1,800-m International Civil Aviation Organization (ICAO) Code 2² airstrip located on the same side of the Purari River as the CPF, new logistics base and accommodation.
- **Option 2:** Use and expand the existing airstrip on the southern side of the Purari River to Code 2. This option requires upgrading the existing ramp to allow personnel to be transported across the river to the new logistics base. It would allow emergency landings of Code 3 aircraft.
- **Option 3:** Design and build a new smaller Code 1 airstrip north of the Purari River while also upgrading the existing Code 1 airstrip south of the river, which would be used only during the construction phase.

The Project undertook a qualitative analysis of these options, which considered:

- Technological hazards – landslide and flood risks, and soil quality.
- Human exposure – impacts on nearby communities, the risk to personnel associated with the river crossing and the access to medical evacuation.
- Logistics transport – the ease and comfort for personnel, and the access in case of unplanned or emergency events at site.
- Operational complexity – the operations of aviators for landing and take-off operations, the access for maintenance and fuelling, and the constraints associated with two airstrips operating simultaneously.
- Construction hazards – earthworks required, the access to the temporary construction camps and construction areas, construction permissions and the access to expand areas if required.
- E&S impacts – of affecting new areas, on communities during the construction and of continuously using the river, especially during the peak of the construction phase.

Option 3 was discarded because of its limitations (e.g., emergency evacuation and transportation of materials).

Option 1 (new airstrip north of the Purari River) had the advantage to negate the need for personnel transfers across the river; however, it carried adverse E&S impacts, e.g., the need to clear a large area of vegetation, and its closeness to the sensitive oxbow wetlands.

Option 2, involving the upgrade of the existing airstrip to Code 2 is the preferred option because of its lower capital costs and reduced environmental footprint. The Purari Airstrip House is the nearest receptor (immediately next door to the Purari Airstrip) and Poroi 1 is the nearest village to the existing Purari Airstrip (approximately 2.8 km).

Equipment and Construction

Equipment and construction materials will be stored at a supply base in Port Moresby prior to transit to the Project area. Materials and equipment will be barged across the Gulf of Papua and up the Purari River to PRL-15 from either of these bases. The Purari River finishes in a complex delta with many arms, and there are several entry points from the sea. An analysis of river transport routes was undertaken to assess the best option for transporting equipment from Port Moresby to the logistics base.

Three branches were assessed for navigability and their capacity to support high-draught barges: the Purari River (eastern branch), the Urika-Ivo River (central branch) and the Wame-Varoi River (western branch). Water level variability is a key issue with water transport on the Purari River and its delta rivers. Water levels can change very quickly and are not seasonally predictable. The analysis initially recommended the Ivo as the most navigable route for river transport, but the preferred route is via the Aiele Passage and the lower Purari

² Runway length 800–<1,200 m

River. Local vessel masters currently use this route, which has a river mouth crossing that is considered easier than the Ivo river mouth crossing. The Urika-Ivo River is, therefore, considered as a secondary transport route to be used when the lower Purari River is not navigable, and the Wame-Varoi was discounted.

3.5.8 Dredging & Barging

Dredging Strategy

A Dredging & Barging Impact Assessment (D&B ESIA (2025) was completed in August 2025. Within the Purari system, there are three main distributaries, each of which provide a potential logistics route between the Gulf of Papua and PRL-15. From east to west these are: the Purari River main arm, the Ivo River (also known as the Urika-Ivo), and the Wame-Varoi.

Of these systems, the Wame-Varoi was discounted due to its greater distance and lower existing disturbance compared to the other rivers. Of the remaining two options, the Purari River was selected as the preferred due to a lower level of navigational constraints, thereby necessitating a lower level of dredging and maintenance.

The options that have been considered are:

- **Option 1:** Base case multiple dredging sites throughout the Purari River
- **Option 2:** Do nothing (i.e. no dredging or alternatives).
- **Option 3:** Adoption of an alternative (non-riverine) logistics route, e.g. road.
- **Option 4:** Adoption of an alternative barge design that has a shallower draft, allowing for program with no or less dredging requirements.
- **Option 5:** Using non-dredging options to provide improved navigation (e.g. bed levelling, scheduling of barging activities).
- **Option 6:** Adoption of an alternative channel design that has a lower dredging volume – this is specific to the Purari River mouth only, where the size of the bar provides for a range of depths and widths to be tested.
- **Option 7:** Modifying the construction program to reduce barging needs.
- **Option 8:** Undertaking only some of the dredging campaign (i.e. priority sites only).
- **Option 9:** Use of the Wame-Varoi River.
- **Option 10:** Use of the Ivo River.

The advantages and disadvantages of these options are considered below in Table 3-12.

Table 3-12: Consideration of alternatives to dredging

Option No.	Option	Advantages	Disadvantages	Evaluation
1	Proposed option – dredging multiple sites throughout the Purari River	Achieves navigational outcomes in greatest range of environmental conditions for design vessel	Higher volume of dredged material to be managed	Preferred
2	No dredging – do nothing	No E&S impact	Does not achieve engineering needs for the Project; has the	Not economically viable

Option No.	Option	Advantages	Disadvantages	Evaluation
			practical effect of making the Project unviable	
3	No dredging – non-riverine logistics route	No E&S impact in the riverine environment	Introduces significant E&S impacts to terrestrial environment; significant lead times to design and implement, especially if not supported by any riverine logistics	Not economically or technically viable
4	No or reduced dredging – alternative barge option	No/reduced dredging-related E&S impact	It is unlikely there is any barge that will not require any dredging due to shallow areas in some parts of the river; if feasible, the size of the barge would require significantly more barge movements which increases E&S risks and could be uneconomical	Not technically viable; poses significant E&S risks
5	No or reduced dredging – scheduling of barges	No/reduced E&S impact	Significantly constrains logistics; not practical during periods of low rainfall or constrained flow, thereby eliminating barging for large parts of the year	Not economically or technically viable
6	No or reduced dredging – bed levelling	No/reduced at sea placement	The volume of material requiring bed levelling will create equivalent if not greater environmental impacts	Not technically viable; greater
7	Reduce dredging - change construction program	Reduced at sea placement	Changing the construction program can allow for greater flexibility in scheduling barge movements (as per Option 4) but is not likely to be economically feasible and will enhance construction-related E&S impacts	Not economically viable; poses enhanced environmental and social risks
8	Reduce program – reduce dredge channel design (Purari River mouth)	Reduced at sea placement	The preferred design is for 130m at -2.9mLAT whereas narrower (80m) and shallower (-1.4mLAT) design could be adopted. However, this limits the period of the tidal cycle during which the bar can be crossed and creates a single fairway for vessel movements. This will lead to queuing of vessels either side of the bar while waiting to cross, reducing efficiency and increasing the risk of navigational incidents	Poses significant maritime safety risk
9	Alternative location – Wame-Varoi River	No dredging or placement in the Purari River	Shifts dredging and placement needs to the Wame-Varoi; at present, Wame-Varoi is mostly undisturbed so shift of impacts	Not E&S viable

Option No.	Option	Advantages	Disadvantages	Evaluation
			leads to comparatively greater disturbance than dredging the Purari	
10	Alternative location – Ivo River	No dredging or placement in the Purari River	Shifts dredging and placement needs to the Ivo River; estimates are that there are more navigational constraints, especially at the mouth, and higher dredging and placement needs	Less viable than Purari River dredging

Based on this assessment, only the dredging of the Purari River, with associated placement activities, is considered viable without undue E&S impacts.

Disposal Option

Alternatives to at sea placement are in relation to those activities associated with navigational dredging and aggregate dredging. The main alternative to 'at sea placement' or other placement would be in river placement and the re-use of dredge material. This could have several environmental benefits. However, several assessments will be required to see if the property of the material is suitable for beneficial reuse, and a cost-benefit analyses of using dredged material as its possible re-use could increase costs. At present it is not clear if the material would have commercial value when the cost of transport and desalination of material is included. As the current method proposes at sea or in river placement, in accordance with the London Convention, in assessing an application to place dredged material at sea, it is necessary to consider any alternatives. Table 3-13 sets out a range of theoretical placement scenarios. These represent the 'baseline' for the purpose of identifying and analysing specific options.

Table 3-13: Theoretical placement scenarios

Scenario	Description	Examples
Offshore placement (close)	Placement of material beyond the area of immediate coastal processes, approximately 3 nautical miles from the shore.	Offshore placement sites in the northern Gulf of Papua
Offshore placement (continental shelf)	Placement of material beyond the edge of the 'continental shelf' associated with the northern Gulf of Papua.	Offshore placement sites in the mid part of the Gulf of Papua
Nearshore placement	Placement of material within the area of immediate coastal processes, less than 3 nautical miles from the shore.	Placement sites near the mouth of Purari River
Onshore placement – beach renourishment or land filling	Placement of material at one or more coastal locations as fill or nourishment material.	Placement at Apiopie
Onshore placement - reclamation	Placement of material at one or more newly developed reclamation sites.	Development and utilisation of a new reclamation area at Orokol Bay

Of the theoretical scenarios presented, two were immediately discounted. These are offshore placement beyond the continental shelf and onshore placement in new reclamation sites. Both options are highly impractical and costly, with the development of new reclamation sites also likely to cause undue environmental harm and/or impact to community land and use of the coast.

The placement options for all dredging sites determined in for navigability purposes are considered in Table 3-14. In each instance, the preferred placement options are considered the most feasible.

Table 3-14: Dredging Sites (navigability) Placement Options

Dredging sites for navigability	Alternative placement options	Justification	Evaluation
ARM000	Onshore placement of all or some of the dredged material	Material expected to be characterised as fine material which is typically unsuitable for beneficial reuse. Onshore placement would also require a significant facility for dewatering and long-term drying before the material could be used.	Not technically viable; poses significant E&S risks
	Placement of all or some of the dredged material further offshore	The distance of the dredging site to the Gulf of Papua is significant and would require the pumping of dredged material into barges and transit down the Purari River and across the bar, increasing safety risk, significant logistical constraints and timing impacts.	Not economically or technically viable
	Instream placement of the dredged material in the Purari River	Instream placement of material would require the pumping of dredged material into barges and transit upstream the Purari River, increasing safety risk, significant logistical constraints, and timing impacts. Hydrodynamic processes would also move the material back to the Purari River mouth.	Not economically or technically viable
	Placement of material within the nearshore environment	Nearshore placement keeps dredged material in the active coastal environment and allows for dredged material placement to occur via floating pipeline rather than the need to double-handle material into barges.	Preferred
ARM021, ARM041, ARM042, ARM043, ARM044, ARM052, ARM062 to ARM068, ARM070	Onshore placement of all or some of the dredged material	No immediate areas adjacent to the dredging sites where onshore placement could occur. Significant clearing of land would have to occur to establish appropriate placement sites.	Not technically viable; poses significant E&S risks
	Offshore placement of all or some of the dredged material	The distance of the dredging site to the Gulf of Papua is significant and would require the pumping of dredged material into barges and transit down the Purari River and across the bar, increasing safety risk, significant logistical constraints and timing impacts.	Not economically or technically viable
	Instream placement of the dredged material in the Purari River.	Instream placement maintains sediment in the natural sedimentary system.	Preferred

3.5.9 Summary of Major Design Changes since 2019

Table 3-15 below describes the key design change highlights that the Project has introduced during the FEED process, and where applicable, their key associated environmental and social impacts. These design changes

are sourced from the EIS Addendum (2024), FEED Changes EAR (2025) and the Hou Creek Aggregate Dredging EAR (2025).

Table 3-15: : Design Change Highlights and E&S Impacts

Major Design Change	Key Design Detail and E&S Impact (where applicable)
Acid Gas Reinjection from Start-Up	Design changed from partial/delayed reinjection to full reinjection of acid gas (CO ₂ and H ₂ S) from first gas production. This avoids the initial years of atmospheric release envisaged under the original concept and is estimated to reduce Project GHG emissions by avoiding the release of the 5 to 20% of the acid gas that would otherwise have been released into the atmosphere during the incineration process. Other benefits include likely reduction of community concern associated with routine visible emissions.
Changes to wellpad production	Additional production well at ELK – 10; additional ELK flowline; and injection wellpad ANT-11 moved from existing ANT-1 site to existing ANT-4 site for more efficient acid gas reinjection.
Produced Water Reinjection (PWRI)	Produced water will be treated and reinjected, rather than discharged to the Purari River. This eliminates routine operational wastewater discharge to freshwater ecosystems and downstream users.
CPF Relocation and Footprint Optimisation	Relocation of the CPF from P2C to P3 reduced the overall footprint by approximately 40 ha and allowed optimisation of roads and infrastructure. The reduction of cut and fill profile reduced aggregate needs. Reuse and upgrade of Herd Base allowed the cancellation of the New Logistic Base and future Operation Camp. Shared routing of roads and trunklines/flowlines platforms, reduction of length and rerouting of Road R03, and Road R02 was eliminated, reducing forest clearance, habitat fragmentation and land acquisition requirements. Purari River crossing HDD location of export pipelines also were adjusted/rerouted. Total upstream footprint reduced to approximately 834 ha.
Pipeline Export Route	Additional compression at CPF resulting from the reduction of the gas export pipeline from a 40" to a 30" diameter.
Offshore Export Pipeline Re-routing	Offshore pipeline rerouted to the east of the existing PNG LNG pipeline to avoid multiple crossings. This reduces seabed disturbance, construction complexity and operational risk.
Offshore condensate pipeline re-routing to FSO	Condensate export redirected to a third-party FSO rather than original design to Caution Bay. This change eliminates the need for the CALM buoy and related condensate facilities at Caution Bay such as PLEM and offshore condensate pipeline running the length of the coast. This also eliminates the need for an expanded permanent maritime exclusion zone. This substantially reduces marine footprint, fisheries impacts, vessel disturbance and impacts to artisanal fishers in Caution Bay. Instead, a new offshore infrastructure was introduced to allow the condensate to be transported to the FSO, including a PLEM and flexible riser connecting the condensate pipeline to the FSO . This change also allowed the condensate pipeline length to be reduced significantly (approx. 320 km to 156 km), lowering design pressure and simplifying the export system.
Caution Bay HDD Shore Crossing	Shore crossing changed from open-cut trenching to HDD, and routing moved north of the existing jetty. This avoids direct impacts on mangroves and nearshore habitats and reduces export pipeline length by approximately 7 km, providing one of the main biodiversity improvements in the Project.
Aggregate sourcing: Quarries and Borrow areas	Aggregate sourcing has evolved from relying mainly on quarries and borrow pits to a more locally focused, lower-impact strategy that also incorporates river-based extraction through the new Hou Creek Aggregate Dredging operation within PRL-15.
Dredging	The number of dredging locations in the Purari River increased, supporting construction logistics and maintaining river navigability. Dredging has ecological and social impacts on riverine habitats and communities which are assessed in the D&B ESIA (2025).

3.5.10 “No-Project” Option

EIS (2019) covered a ‘no-project option’ that considered a scenario where the Project failed to go forward. This noted there would be no adverse E&S impacts associated with Project development as no construction or operational activities would take place. However, it would also forego important potential benefits, including royalty and equity flows to landowners, local employment and business opportunities, and prospects for co-investment in public services and infrastructure. Communities would likely continue to face existing development deficits (limited services, poor connectivity, unmet livelihood needs) and unmanaged pressures from other projects or informal resource use.

3.6 Associated Facilities

The Project is required to identify Associated Facilities that could meet the IFC PS1 definition, which is:

“facilities that are not funded as part of the Project and that would not have been constructed or expanded if the Project did not exist and without which the Project would not be viable”

In the document Papua LNG Associated Facilities (2025), the Project has defined an approach for identifying Associated Facilities, which can be seen in Figure 3-11:

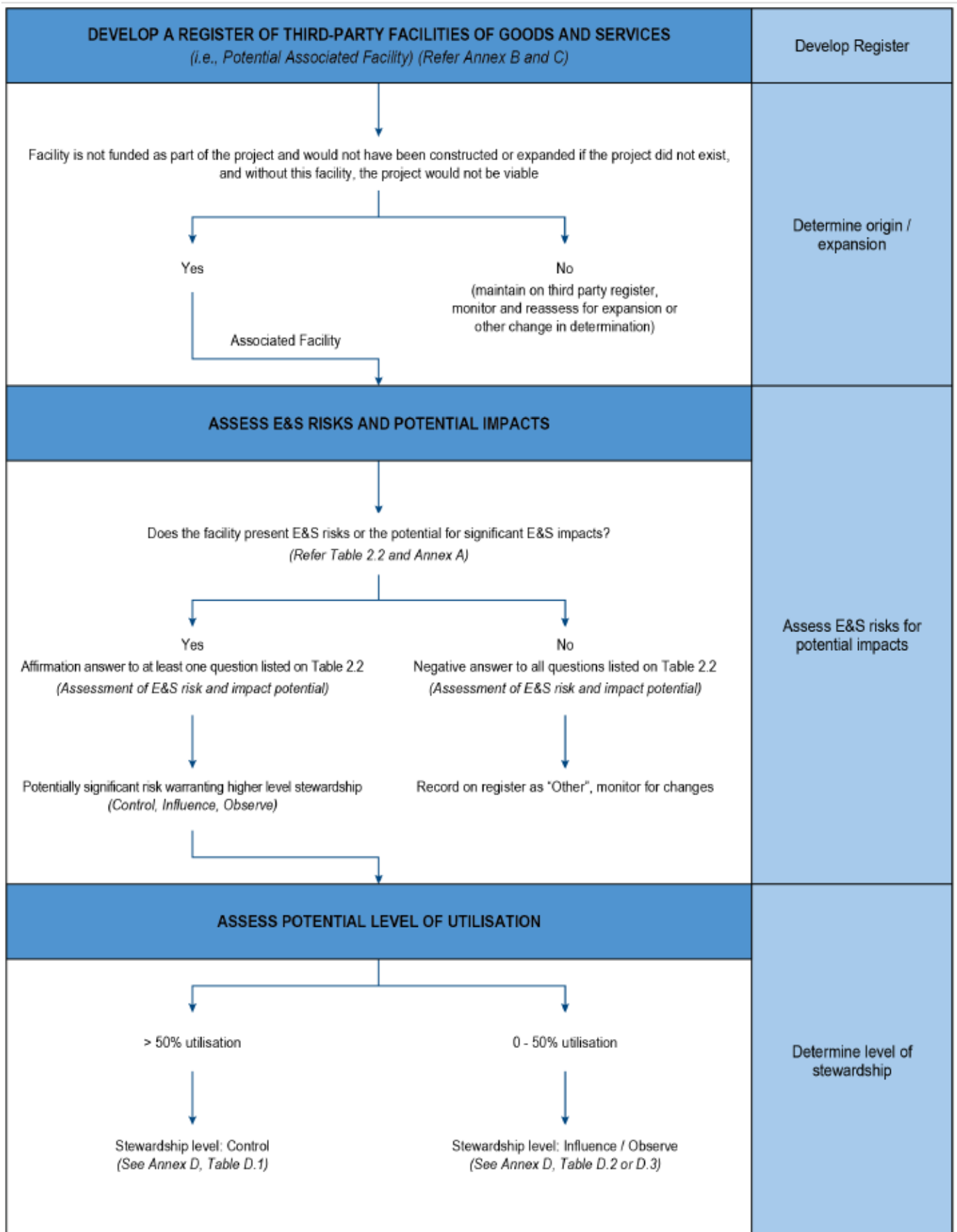


Figure 3-11: Project decision tree for identifying Associated Facilities. Source: (Associated facilities, 2025)

That same document identifies a range of potential facilities that would need to be assessed against the steps defined in Figure 3-10 to confirm their status as an Associated Facility. This assessment is yet to commence.

These potential facilities fall into the broader categories of:

- Waste management
- Quarries and borrow pits
- Installation of communications infrastructure such as fibre optic networks (onshore)
- Installation of communications infrastructure such as fibre optic networks (offshore)
- Supply bases and warehouses
- Port, storage and trans-shipment facilities
- Fabrication yards

To date a single Associated Facility is anticipated by the Project. That is:

- Floating Storage and Offtake (FSO)

4 Regulatory Framework, Policies, Standards and Guidelines

4.1 Introduction

This section presents a synthesis of Project documentation pertaining to the main laws, regulations and policies applicable to the Project at the date of this report, and good practice standards and guidelines that have informed the preparation of this document, or previous EIS documentation.

4.2 National Requirements

The Project is subject to two principal pieces of legislation regulating oil and gas development in PNG: the Environment Act 2000 (and associated regulations and guidelines) and the Oil and Gas Act 1998. Additional PNG laws and technical guidelines address specific environmental, social, health, safety, and cultural heritage considerations.

Environment Act 2000

Under the *Environment Act 2000* and the *Environment (Prescribed Activities) Regulation 2002*, the Project is classified as a Level 3 activity. This classification required a full Environmental Impact Assessment (EIA) and the issuance of an environment permit prior to commencement. The EIS process required submission to CEPA, preliminary review, public consultation, consideration by the Environment Council, and recommendation to the Minister for Environment for approval in principle. Following ministerial approval, CEPA finalised and issued the environment permit with conditions.

The following provides a timeline of the key steps TEP PNG undertook in compliance with the Act:

- Submitted a *Notification of Intent* to carry out preparatory works³ (October 2015).
- Submitted an *Environment Permit Application* (October 2015), after which the Project was confirmed to be a Level 3 classification and required an EIA.
- Submitted an *Environmental Inception Report* in October 2016, approved in December 2016.
- Prepared the *Environmental Impact Statement* (EIS) in accordance with the PNG guidelines and CEPA guidelines, incorporating environmental, social, and economic impact assessments. Submitted in December 2019.
- Submitted the Upstream Project Construction Environment and Social Management Plan hereafter referred to as CESMP (2021) in September 2021.
- EIS roadshow took place in 2022.
- Prepared an addendum to the EIS (2019), capturing substantial changes to the Project description and the associated E&S impacts that require assessment under *the Environment Act 2000*. Submitted in December 2024.

³ The term "Preparatory Works" in the context of sections 48 and 49 of the Environment Act (2000) is different from the term "Preparatory Works" in the context of the Project. Preparatory Works under the Act refers to the collection and generation of ESBS, EIA, EIS, etc. Preparatory Works for the Project means "enabling works" or a set of construction activities that will enable the full Project to proceed; e.g establishment of roads and access, tree felling, some camp facilities, and for which a Level 2 Environment Permit was granted (although this has now been superseded by the L3 permit). Note: Sections 48 and 49 were repealed as part of the *Environment (Amendment) Act 2014* (No. 10 of 2014), section 18.

- The Project was issued a Level 3 (L3) Permit - EP-L3 (1030) - by CEPA 9 September 2025 (expiry date September 2050).
- The Project was issued an amendment to L3 Permit – EP-L3 (1030) on 7 May 2026 following CEPA assessment of the FEED Changes EAR (2025)
- The Project was issued an amendment to L3 Permit – EP-L3 (1030) on 6 August 2026 following CEPA assessment of the Hou Creek Aggregate Sourcing EAR (2025).

CEPA's guideline for submission of an application for an environment permit to discharge waste (GL-Env/03/2004) covers: noise discharges (IB-ENV/03/2004); air discharges (IB-ENV/02/2004); and water and land discharges (IB-ENV/04/2004). These guidelines informed discipline-specific assessments, including air, noise, land/water discharges, sewerage treatment, and waste management for the Project and informed the EIS (2019).

Oil and Gas Act 1998

The *Oil and Gas Act 1998* governs licensing for exploration, development, production, processing, and transportation of petroleum. The Project holds *Petroleum Retention Licence* PRL-15 (granted November 2010; expires November 2026). From November 2026, construction will be carried out under the following licence structure:

- *Petroleum Development Licence* (PDL) – to cover the area within the existing PRL-15 that will continue to be used for gas reservoirs,
- *Pipeline Licence(s)* for transport of raw gas and condensate/gas export pipelines.
- *Petroleum Production Facility Licence* for upstream and downstream facilities.

Consideration of E&S aspects is required prior to issuance of a PDL. The Minister for Petroleum is required to be satisfied that the Project adequately addresses environmental protection and community welfare. TEP PNG completed a full-scale SMLI study in accordance with Section 47 of the Oil and Gas Act, and prepared a socio-economic impact assessment in line with EIS Vol. 1, Chapter 13 Impacts Social (2019), hereafter referred to as EIS Impacts Social (2019), to meet licensing prerequisites. These were submitted to the Department of Petroleum (now the National Petroleum Authority) prior to the State convening the development forum, itself a prerequisite for PDL issuance.

Under the Oil and Gas Act, land access rights associated with petroleum development licenses are to be sought and granted in accordance with the relevant statutory provisions, with affected lawful landowners entitled to compensation determined in accordance with the Act and applicable valuation processes. Land access and compensation arrangements have been implemented alongside the Project's stakeholder engagement and ICP and FPIC processes with affected communities.

Other PNG Legislation and Guidelines

The following table (Table 4-1) summarises other PNG legislation and guidelines relevant to regulating environmental and socio-economic performance of Project development and operational activities.

Table 4-1: Summary figure of other relevant national legislation and guidelines (Source: adapted from EIS Vol. 1 Ch. 02 Regulatory Framework, Standards, Process & Guidelines, 2019, hereafter referred to as EIS Regulatory Framework (2019))

Legislation/Regulation	Description
Environmental & Biodiversity Legislation & Regulations	
Environment (Water Quality Criteria) Regulation 2002	Establishes water quality criteria for protecting freshwater and marine aquatic life; project discharges must meet prescribed standards.

Legislation/Regulation	Description
Protected Areas Act 2024 ⁴	Governs the declaration, management, and financing of protected areas by integrating biodiversity conservation, customary land rights, and sustainable development obligations.
International Trade (Fauna and Flora) Act 1979, International Trade (Fauna and Flora) (Amendment) Act 2014	Promoting sustainable use of fauna and flora, implementing PNG's obligations as a party to CITES; amendments update provisions for international trade in endangered species.
Marine Environment Protection Legislation	
Marine Pollution (Sea Dumping) Act 2013 and Marine Pollution (Sea Dumping) Regulation 2013	Regulates dumping and incineration of waste at sea; requires permits and sets contaminant guidelines for dredged material; regulation provides contaminant criteria and operational details.
Marine Pollution (Preparedness and Response) Act 2013	Mandates a comprehensive system for spill response systems for oil, chemicals, and other pollutants from vessels and facilities; requires marine pollution risk assessment for new petroleum-related facilities.
Marine Pollution (Ships and Installations) Act 2013	Prevents and controls marine pollution from ships and offshore installations; incorporates relevant IMO conventions.
Marine Pollution (Ballast Water Control) Act 2013	Controls introduction of harmful aquatic organisms via ballast water; incorporates IMO Ballast Water Convention.
Maritime Zones Act 2015	Provides marine environmental protection, designation of protected areas, accident prevention, and management of underwater cultural heritage.
Waste and Materials Regulations	
Draft Environmental Guideline for Sewerage Treatment and Disposal 2009	Guidance for planning and managing sewerage treatment and disposal facilities.
Environment (Registration of Contaminants and Hazardous Contaminants) Regulation 2011	Regulates the registration, handling, and control of contaminants and hazardous contaminants in PNG to protect human health and the environment.
Environmental Code of Practice for Sanitary Landfill Sites 2001	Guides landfill planning/design to prevent environmental harm and promote waste reduction.
Cultural Heritage Legislation	
National Museum and Art Gallery Act 1992	Requires registration and protection of cultural heritage and archaeological sites identified during development.
National Cultural Property (Preservation) Act 1965 and National Cultural Property (Preservation) Regulation 1965	Protects cultural property of national importance, including traditional cultural objects and archaeological sites; regulation provides operational detail for implementing the Act.
Public Health and Safety Legislation	
Public Health (Drinking Water) Regulation 1984	Sets water quality criteria to ensure suitability for human consumption.
Public Health Act 1973 and the Public Health (Sanitation & General) Regulation 1973	Provides the legal framework for protecting and promoting public health in PNG. Covers a broad range of public health issues including

⁴ At the time of the EIS (2019), the Fauna (Protection and Control) Act 1966 as Amended, and the Conservation Areas Act 1978 as Amended were the key relevant legislations concerning conservation areas and wildlife protection. These have now been replaced by the Protected Areas Act (2024).

Legislation/Regulation	Description
	disease prevention, sanitation, hygiene, and control of infectious diseases.
Water Supply and Sewerage Act 1996 and the Public Health (Sewerage) Regulation 1973	Governs the provision, management, and regulation of water supply and sewerage services in PNG.
Public Health (Septic Tank) Regulation 1973	Regulates the installation, maintenance, and operation of septic tanks as part of sanitation management
Fisheries & Forestry Legislation	
Fisheries Management Act 1998, Fisheries Management Regulation 2000, Fisheries Management (Amendment) Regulation 2016	Regulates fishing activity via management plans, allowable catch limits, and fishing zones; amendments update fisheries management provisions.
Forestry Act 1991 and Forestry Act Amendments 1993, 1996, 2000, 2005, 2010	Governs commercial forestry operations and timber rights; amendments update forestry regulation and timber rights provisions.
Technical Guidelines	
CEPA Technical Guideline (Additional Information): Air Discharges – IB-ENV/02/2004	Details information required for environment permit applications where air emissions may occur.
CEPA Technical Guideline (Additional Information): Noise Discharges – IB-ENV/03/2004	Details information required for environment permit applications where noise emissions may occur.
CEPA Technical Guideline (Additional Information): Land and Water Discharges – IB-ENV/04/2004	Details information required for environment permit applications where emissions to land or water may occur.
CEPA Guideline for Submission of an Application for an Environment Permit to Discharge Waste – GL-ENV/03/2004	Provides instructions for preparing waste discharge permit applications.
Environmental Codes of Practice - Hydrocarbons	
Environmental Code of Practice for PNG Vehicle & Machinery Workshops, Petroleum Storage, Resale and Usage Sites 1997	Guidance for environmentally sound use of hydrocarbon-based materials.
Labour	
Employment Act 1978; Employment Regulation 1980	Guides employment in the formal sector and regulates matters such as work hours, minimum age of work, and gender discrimination in employment and wages
Industrial Relations Act 1962	Regulates employer–employee relations in PNG, including trade disputes, collective bargaining, and the registration and conduct of trade unions and employer organisations.
Industrial Safety, Health and Welfare Act 1961	Sets workplace standards to protect employee safety, health, and welfare.
Constitution of the Independent State of PNG 1975	Establishes fundamental rights and principles that underpin labour and employment protections.

Legislation/Regulation	Description
Employment of Non- citizens Act 2007, Employment of Non-citizens Regulation 2008	Regulate the employment of foreign workers and promotes employment of PNG citizens.
Work Permit Guideline (2009)	Outlines requirements and procedures for issuing work permits to non-citizens.
Industrial Organizations Act 1962, Industrial Organizations Regulation 1963	Govern the formation, registration, governance, and regulation of trade unions and employer organisations in PNG.
Minimum Wages Board	Determines and recommends minimum wage rates and employment conditions for different industries to ensure fair remuneration for workers.
Workers' Compensation Act 1978 and the Workers' Compensation Regulation 1983	Provides for compensation to workers and their dependents in respect of injuries suffered by workers from or during their employment, and for related purposes. The regulation makes provisions for the relevant procedures and forms, and notices of injuries under the Act.
Lukautim Pikinini (Child) Act 2009	Protects and promotes the rights and well-being generally of all children regardless of race, nationality, or sex. The Act defines a child as a person under 18 years of age. It prohibits employing a child in an activity that may be harmful to its health, education, mental physical or moral development or wellbeing.
Superannuation (General Provision) Act 2000	Provides for worker savings for retirement through mandatory or voluntary contributions to superannuation funds by employers and employees.

4.3 Applicable International Standards

Equator Principles

The Equator Principles (EP) are a globally recognised risk management framework adopted by financial institutions to identify, assess, and manage E&S risks in large-scale project finance, including LNG developments. Application of the EPs requires compliance with applicable host country laws and alignment with the IFC PS (see below). Adherence to the EPs supports the Project to access responsible financing and provides assurance to lenders and stakeholders that E&S risks associated with the LNG plant are being managed in a systematic and technically robust manner.

Lenders to the Project use an Independent Environmental and Social Consultant (IESC) to evaluate Project compliance to relevant standards both in pre-financing preparations and for the term of the lending.

OECD Common Approaches

The Organization for Economic Cooperation and Development (OECD) Common Approaches for Officially Supported Export Credits and ESDD set out the minimum standards that OECD member countries apply when their export credit agencies (ECAs) provide financial support to projects with potential E&S risks, such as LNG developments. The Common Approaches are relevant to the Project as they require classification of project risk, preparation of an ESHIA proportionate to potential impacts, and benchmarking against international standards such as the IFC Performance Standards and World Bank Group EHS Guidelines.

For the Papua LNG Project, alignment with the OECD Common Approaches enables E&S risks to be identified early, mitigation measures to be incorporated into project design and operation, and meaningful stakeholder engagement to be undertaken. Alignment with these Common Approaches demonstrates the

Project's consistency with internationally accepted due diligence expectations and supports access to ECA-backed financing.

IFC Performance Standards (2012)

The IFC PS are designed to help avoid, mitigate, and manage E&S risks, while enhancing development opportunities. They are applied by IFC and other international finance institutions to all direct investments, including project and corporate finance.

The eight IFC PSs are:

- PS 1: Assessment and Management of Environmental and Social Risks and Impacts.
- PS 2: Labor and Working Conditions.
- PS 3: Resource Efficiency and Pollution Prevention.
- PS 4: Community Health, Safety, and Security.
- PS 5: Land Acquisition and Involuntary Resettlement.
- PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
- PS 7: Indigenous Peoples.
- PS 8: Cultural Heritage.

The IFC's General EHS Guidelines (IFC,2007) and industry-specific Guidelines set performance levels and measures representing good international industry practice (GIIP) for environmental, health and safety management. Projects seeking direct investment are required to comply with whichever is more stringent — host country law or EHS Guideline standards. Table 4-2 presents relevant IFC EHS Guidelines for the Project to consider.

Table 4-2: Relevant IFC EHS guidelines(Source: adapted from EIS Regulatory Framework (2019))

Guideline	Description
General IFC EHS Guidelines (IFC, 2007)	Covers: • Environmental. • Occupational Health and Safety • Community Health and Safety. • Construction and Decommissioning.
Industry-specific IFC EHS Guidelines	• Shipping (IFC, 2007b). • Waste Management Facilities (IFC, 2007c). • Water and Sanitation (IFC, 2007d). • Onshore Oil and Gas Development (IFC, 2007e). • Offshore Oil and Gas Development (IFC, 2015). • Ports, Harbors, and Terminals (IFC, 2017). • Construction Materials Extraction (IFC, 2007f). • Telecommunications (IFC, 2007g).
Other IFC Guidelines	• Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (IFC, 2013). • Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets (IFC, 2007). • Good Practice Note: Addressing the Social Dimensions of Private Sector Projects (IFC, 2003). • Projects and People: A Handbook for Addressing Project-Induced In-Migration (IFC, 2009). • Addressing Grievances from PACs (IFC, 2009). • Good Practice Handbook Land Acquisition and Involuntary Resettlement (IFC, 2023).

Guideline	Description
	Guidance Note: Worker's accommodation: processes and standards (IFC and EBRD, 2009).

Alongside EP, OECD Common Approaches, and IFC Guidelines, there are several other relevant guidelines and conventions relevant to the Project. Those guidelines and conventions most relevant, based on the current project description, are listed below in Table 4-3.

Table 4-3: Other Relevant International Guidelines and Conventions (Source: adapted from EIS Regulatory Framework (2019).)

Topic	Guideline or convention
Guidelines	
Other Relevant International Guidelines	- Air quality guidelines (WHO, 2005). - Guidelines for community noise (WHO, 1999). - Guidelines for drinking water quality (WHO, 2017) - Biodiversity and ecosystem services fundamentals. Guidance documents for the oil and gas industry - International Petroleum Industry Environmental Conservation Association (IPIECA, 2016). - Oil spill preparedness and response guidelines (IPIECA, 2015). - A Guide to Social Impact Assessment in the Oil and Gas Industry (IPIECA, 2004). - Health Impact Assessment: A guide for the oil and gas industry - IPIECA and International Association of Oil & Gas Producers (IOGP), 2016. - Indigenous Peoples and the Oil and Gas Industry: Context, Issues and Emerging Good Practice (IPIECA, 2012). - United Nations Food and Agricultural Organization (FAO)/ World Health Organization (WHO) CODEX Food standards.
International Frameworks	- UN Guiding Principles on Business and Human Rights (2011) - IFC Sustainability Framework (2012)
Conventions	
ILO Conventions	- Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87). (PNG ratified) - Right to Organise and Collective Bargaining Convention, 1949 (No. 98). (PNG ratified) - Forced Labour Convention, 1930 (No. 29). (PNG ratified) - Abolition of Forced Labour Convention, 1957 (No. 105). (PNG ratified) - Equal Remuneration Convention, 1951 (No. 100). (PNG ratified) - Discrimination (Employment and Occupation) Convention, 1958 (No. 111). (PNG ratified) - Minimum Age Convention, 1973 (No. 138). (PNG ratified) - Worst Forms of Child Labour Convention, 1999 (No. 182). (PNG ratified) - Maritime Labour Convention (2006) (Not PNG ratified; but applied to marine vessels registered in a country that has ratified)
Hazardous Waste Conventions	- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989) - Waigani Convention to Ban the Importation in Forum Islands Countries of Hazardous Wastes and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region (1995)

4.4 TEP PNG Standards and Specifications

TEP PNG is the operator of the Project. TotalEnergies, as TEP PNG's ultimate parent company, sets high corporate social responsibility standards for itself, its affiliates, its suppliers and contractors as specified in the following commitments, codes of conduct, standards and guidelines:

- Group Code of Conduct (TotalEnergies, 2022)
- Group Guide on Human Rights (TOTAL, 2015)
- Respect Human Rights at work, practical guide for suppliers (TotalEnergies, 2022).
- Charter of Principles and Guidelines Regarding Indigenous and Tribal Peoples (TOTAL, 2010)
- Fundamental Principles of Purchasing (TotalEnergies, 2022)
- Safety Health Environment Quality Charter (TotalEnergies, 2021)
- Integrating Climate into TOTAL's strategy (TOTAL, 2017)
- Biodiversity Commitments and actions (TotalEnergies, 2021)
- Water Commitments and actions (TotalEnergies, 2023)
- Environmental and Social Impact Assessment Study of Industrial Project Activities (TotalEnergies, 2023)
- Environmental Baseline and Monitoring Studies: Onshore and Coastal Sites (TotalEnergies, 2022)
- Voluntary Principles on Security and Human Rights (VPSHR) Policy (TotalEnergies, 2024)

5 Stakeholder Engagement

5.1 Introduction

This section presents a synthesis of Project documentation pertaining to stakeholder engagement for the Papua LNG Project. Stakeholder engagement has been undertaken as a continuous process across Project planning, impact assessment, and preconstruction activities, including engagement undertaken as part of the Project's commitment to Informed Consultation and Participation (ICP), as defined in the ICP/ FPIC Implementation Plan (2025), and in accordance with IFC PSs 1 and 7.

Engagement is guided by the Project's Stakeholder Engagement Management Plan (SEMP) and supporting operational procedures, and is implemented through a combination of community liaison, village-level engagement, public meetings, focus group discussions, household engagement, formal communications, grievance processes, and established forums. The approach recognises the Project's complex social setting, and is designed to ensure timely disclosure, two-way dialogue, and effective issue resolution.

This section summarises the engagement framework, stakeholder groups, engagement history, key issues raised, grievance and feedback processes, and how stakeholder input has been recorded and used to inform Project planning, disclosure, and management measures. The scale of engagement is substantial and has been documented in the Project's stakeholder engagement database over an 11-year period. Table 5-1 provides a quantitative summary of the Project's stakeholder engagement records, showing the scale, period and main forms of engagement documented in the Project record. These data show that engagement has been continuous, multi-channel, and embedded in routine Project-community interaction, rather than limited to disclosure events.

Table 5-1: Summary of Stakeholder Engagement Records

Metric	Database Records
Communications records reviewed	13,882
Date range	11 Jan 2015 to 27 Jun 2026
Records tagged at village level	10,012
Village/location names	189
Distinct named stakeholders, individuals or organisations	4,497
Staff members involved in engagement	366
Named engagement plans/programmes	558
Formal communications	6,484
Informal/routine communications	7,398
Meetings	6,958
Phone contacts	5,526
Letters	1,089
Toll-free line contacts	4,094

Stakeholder engagement has also informed refinements to design and the way residual impacts are managed. For Project changes that could affect land access, cultural heritage or livelihood resources, engagement provided a mechanism to disclose the nature and timing of works, record community feedback, identify location-specific sensitivities, and feed practical mitigation preferences into construction planning and management controls. This linkage between design optimisation and ongoing engagement was

particularly important where impacts cannot be fully avoided and need to be managed through advance disclosure, land access processes, grievance management, monitoring, and adaptive response.

5.2 Engagement Framework and Governance

The Project's stakeholder engagement framework links strategic commitments, field implementation, and issue resolution through a tiered system.

At the strategic level, the Stakeholder Engagement Management Plan (SEMP) establishes the engagement principles, stakeholder identification approach, disclosure commitments, FPIC interface, roles and responsibilities, monitoring, and audit expectations.

At the implementation level, engagement is delivered through a Community Relations team including Community Liaison Officers (CLOs), and Village Liaison Officers (VLOs), land access specialists and contractor interface requirements, with records captured in the database.

At the issue-management level, the Community Grievance Procedure (CGP) provides the process for receiving, registering, investigating, escalating, resolving, and closing community concerns and grievances.

The Indigenous Peoples Framework and ICP/FPIC documentation provide the rights-based process for engagement with Indigenous communities, including differentiated engagement where impacts affect customary land, natural resources, or cultural heritage.

This structure creates a traceable pathway from disclosure and consultation to issue identification, to assigned actions, to Project response and feedback to stakeholders.

5.3 Roles, Capacity, and Resources

Engagement implementation is led by the Project's Community Relations team, CLOs, land access specialists, and a network of approximately 30 VLOs located across the PAoI. CLOs act as the primary interface with communities, facilitating engagement, and relaying concerns and grievances. The Head of Community Relations oversees engagement strategy, grievance management, reporting, and compliance.

All contractor engagement with communities is required to be coordinated through the Project. Communication channels and tools include regular CLO and VLO visits, public meetings, Focus Group Discussions (FGD), household visits, newsletters, brochures, pictorial materials, banners, and a tollfree hotline supported by radio and mobile phone coverage. Materials are prepared in different languages and formats according to literacy levels and accessibility constraints.

The Project seeks to address gender inclusion within its stakeholder engagement workforce by deploying two VLOs for each community, one male and one female. This helps reduce cultural and social barriers to women's participation by enabling gender-appropriate communication, improving access to information, and supporting women's ability to raise concerns and participate meaningfully in consultations. The Project's commitment to gender representation is also embedded in operational practice, through participation in gender-related initiatives in PNG including community partnerships and awareness campaigns focused on women's empowerment.

5.4 Stakeholder Identification, Analysis and Inclusion

The Project's stakeholder engagement is informed by a stakeholder identification and categorisation process that distinguishes rightsholders from other stakeholder groups, and considers levels of potential impact, influence, and vulnerability. Stakeholder input is systematically reviewed at an issue level, with recurring themes (including land access and livelihoods, river and marine impacts, community health and safety,

biodiversity, and employment opportunities) identified through consultations and grievance processes. These issues are used to inform refinements to project design, management measures, disclosure materials, and grievance handling practices, with an expressed commitment to feedback loops where responses to stakeholder concerns are communicated back to affected communities. For example, in the recent redesign of the Orokolo Bay PER shore landing, concerns of community impacts led the Project to amend the design of the EIS-approved approach, and to integrate measures for mitigating shoreline access into the construction approach. River transport/traffic management has also enforced additional procedures for vessels, along with CCTV cameras, to help ensure community impacts are monitored and addressed quickly.

5.4.1 Key Stakeholders

Key stakeholder groups for the Project include:

- **Project-Affected Communities (PACs) and Persons:** Includes local communities, customary landowners, community leaders, and vulnerable groups directly or indirectly affected by project impacts. Some PACs are further disaggregated as part of the project's Land and Livelihood Processes for FPIC, compensation, and benefit streams. See Figure 5-1 for a map of potentially affected communities in the PAoI.
- **Non-Governmental Organisations (NGOs):** NGOs with an interest in the Project's potential economic, social, environmental, cultural, and human rights impacts.
- **Civil Society & Community Service Organisations:** Government and non-governmental civil society groups, including those potentially partnering on community development initiatives.
- **Industry and Business Groups:** Businesses and industry groups operating within or near the Project area, with commercial or economic interests.
- **Government Authorities (Provincial, District, LLG):** Provincial governments, districts, and Local Level Governments (LLGs) with administrative oversight and regulatory interest.
- **Other Communities Outside the Project Area of Influence:** Communities in the wider region such as Kerema and Port Moresby, and community leaders from PAoI villages living in urban centres.

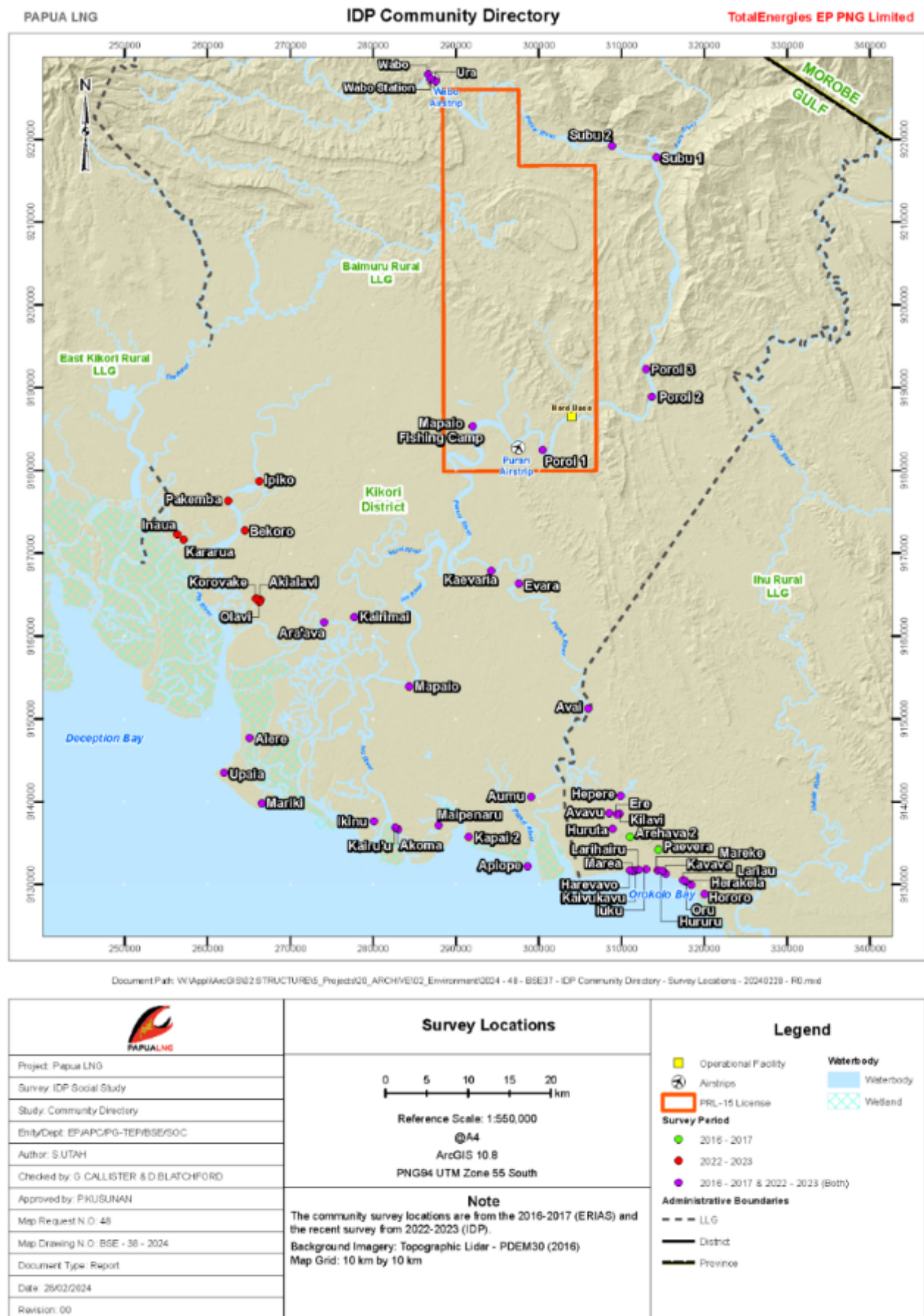


Figure 5-1 Potentially Affected Communities in the PAOL. (Source: Community Health, Safety and Security Management Plan, 2026)

5.4.2 Vulnerable Groups

The Project considers the following groups as vulnerable for purposes of stakeholder engagement and inclusion:

- Women, particularly where livelihood roles, safety risks, or access to decision-making are constrained.
- Children and youth, in relation to health, education disruption, and community safety.
- Elderly persons, due to reduced mobility and dependence on traditional support systems.
- Subsistence fishers, gardeners, and sago producers with high dependence on riverine and natural resources.
- Remote river and delta communities with limited access to services, markets, or alternative transport.
- Customary landholding groups whose social identity, livelihoods, and cultural practices are closely tied to land and water resources.

Importantly, the Project recognised that vulnerability is context-specific and may vary within and between communities and over time, rather than applying a fixed or generic label. The Project determined the vulnerability of these groups by drawing on its social and demographic baseline for communities within the PAol, specifically:

- National census and administrative data (population size, age structure, household composition).
- Village-level profiling undertaken during baseline surveys.
- Information on language groups, kinship systems, and customary land tenure.
- Socio-economic characteristics such as livelihoods, education, health access, and infrastructure availability.

This baseline work is documented in the EIS (2019) social baseline chapters and carried forward into later studies and assessments, to help ensure continuity of demographic understanding across Project phases.

Using the baseline, the Project identified social receptors, namely population groups that could reasonably be affected by Project activities. Receptors were defined spatially (e.g. PRL-15 area, river transport corridor, coastal and delta communities) and socially (e.g. livelihood groups, language groups, governance structures).

Special attention was given to:

- River-dependent communities along the Purari River.
- Subsistence-based households with limited income diversification.
- Communities with limited access to services or alternative transport routes.

These receptors formed the basis for later vulnerability screening and impact assessment.

Vulnerability was not determined solely by demographic category, but through a set of defined criteria, consistent with international standards. As set out in the EIS SIA methodology, vulnerability was assessed by examining:

- Sensitivity: underlying socio-economic conditions such as poverty, health status, food security, reliance on natural resources, social cohesion, and governance capacity.
- Exposure: the degree to which specific groups were likely to experience Project-related changes (e.g. land access, river traffic, in-migration, noise, or safety risks).

- Adaptive capacity: the ability of individuals or groups to cope with, adapt to, or benefit from change (e.g. access to alternatives, voice in decision-making, grievance access).

Demographic findings and vulnerability assumptions were validated through consultations and applied directly to impact significance ratings, mitigation design, grievance accessibility, and FPIC-related decision-making. Community feedback was used to confirm which groups experienced heightened sensitivity or reduced capacity, particularly in relation to livelihoods, river use, and safety concerns. This helped ensure that vulnerability analysis directly influenced Project decision-making rather than remaining a descriptive exercise.

5.4.3 Barriers to Engagement

Stakeholder engagement for the Project primarily takes place in a remote, linguistically diverse and low-literacy context, with logistical and social constraints influencing participation. To overcome these barriers, the Project undertakes engagement primarily in local languages, supported by CLOs and VLOs drawn from or familiar with local communities, to facilitate communication and comprehension.

The Project uses visual and verbal communication tools (including grievance brochures and awareness materials) to supplement written materials, reducing barriers linked to literacy and language. The Community Grievance Procedure is structured to allow grievances to be raised orally and in person, as well as through written or mediated channels, reducing reliance on formal complaint processes in order to increase accessibility.

Grievance awareness sessions and outreach activities are undertaken on an ongoing basis to inform community stakeholders of the mechanism's multiple access points and remind them that assistance is available to lodge grievances where required.

The Project's engagement approaches seek to ensure women's participation through various measures including targeted awareness activities and gender-sensitive consultation practices. Security constraints and access challenges along riverine and remote locations are recognised in engagement planning, with consultations often aligned to safe access windows and coordinated with community leadership structures.

5.4.4 Free, Prior and Informed Consent (FPIC) Approach

As part of the Project's broader ICP/FPIC approach, FPIC is treated as a continuing, evidence-based process rather than a single approval event. The Project's approach is set out in the ICP/FPIC Implementation Plan (L2-PLN-SDV-18) and the Indigenous Peoples Framework (IPF) (L2-PLN-SDV-40), and is implemented through Project stakeholder engagement, land access, compensation, cultural heritage and livelihood planning processes. The approach recognises that communities and clans within the PAOI are Indigenous Peoples for the purposes of IFC PS7, and that customary land, waterways, riverine resources, coastal and marine areas, and cultural heritage are central to identity, livelihood security and decision-making.

FPIC is applied where Project activities may result in significant or long-term adverse impacts on customary land, natural resources, river and coastal access, or sites of cultural or spiritual importance. ICP is applied where impacts are short-term, limited in scope and not expected to result in substantial livelihood or social change. The Project applies a precautionary, sliding-scale approach: Tier 1 communities with cumulative land and waterway/coastal impacts require FPIC; Tier 2 communities with a single significant impact pathway require FPIC or structured ICP depending on impact severity; and Tier 3 communities with short-duration, reversible construction impacts are addressed through ICP. Table 5-2 provides further detail for LALDP South.

The FPIC process includes iterative disclosure, verification of clan representation, culturally appropriate internal deliberation, good-faith negotiation, documentation of decisions and maintenance of consent

through implementation. It builds upon the strategy developed and implemented since 2022 (PRL-15 FPIC Strategy And Progress Report October 2023) and ICP/FPIC Implementation Plan (2025) and is linked directly to Clan Land Use Consent Agreements, In-Principle Compensation Agreements and other land access instruments, while remaining distinct from statutory compensation processes. Where design changes, dredging and barging activities, revised infrastructure layouts or new land access requirements could materially affect Indigenous lands, resources, livelihoods or cultural heritage, the Project is required to re-engage and, where applicable, re-confirm FPIC through the Management of Change process.

Table 5-2: Indigenous Communities in LALDP South and FPIC/ICP Requirement. (Source: Land Access and Livelihood Development South, 2026)

Tiers	Principal Landowning Clan	PAol Village/Community Located on Clan Land	Project Geographical Area	FPIC/ICP Requirement
Tier 1	Ihopue	Pokore Hamlet	Waterway	FPIC
	Lai-Uhe 2	Purari Airstrip House	Waterway	FPIC
	Lai-Uhe 1	Evara	Waterway	FPIC
	Communal land	Aivai	Waterway	FPIC
	Communal land (coastal)	Iuku*	PER corridor, Orokolo Bay coastline	FPIC
		Mareke	PER corridor, Orokolo Bay coastline	FPIC
	Clan not mapped.	Kaevaria	Waterway	FPIC
	Clan not mapped.	Apiope	Waterway	FPIC
Tier 2	All the clans of Hepere	Hepere	PER corridor	FPIC
	14 clans of Ere-Kilavi	Ere	PER corridor	FPIC
	Ipi Harupi	Kilavi	PER corridor	FPIC
	Kela Oeavavo	Arehave 2	PER corridor	FPIC
	Communal land (inland)	Avavu	PER corridor	FPIC
		Muro Mission (excised, government land)	PER corridor	FPIC
		Huruta	PER corridor	FPIC
		Paevera	PER corridor	FPIC
		Harevavo	Orokolo Bay coastline	ICP
		Marea	Orokolo Bay coastline	ICP
		Kaivukovu	Orokolo Bay coastline	ICP
		Larihairu	Orokolo Bay coastline	ICP
		Kavava (includes Hururu, Mirimurua, Miha)	Orokolo Bay coastline	ICP
		Lariau	Orokolo Bay coastline	ICP
		Oru	Orokolo Bay coastline	ICP
		Hiloi	Orokolo Bay coastline	ICP
		Herakela	Orokolo Bay coastline	ICP
		Hohoro	Orokolo Bay coastline	ICP
	Clan not mapped	Aumu	Waterway	FPIC
Tier 3	Clan not mapped	Kido	Offshore PER	ICP
	Clan not mapped	Ala-Ala	Offshore PER	ICP
	Clan not mapped	Oroi	Offshore PER	ICP

FPIC is also linked to the LALDPs. The North and South LALDPs translate negotiated commitments into livelihood restoration and development measures, including compensation at replacement cost, food security and agriculture support, fisheries and river/coastal livelihood support, micro-credit and community funding support, and education, workforce participation and capacity building. These measures are intended to maintain or improve clan and community food security, support access to training and employment pathways, and provide culturally appropriate development benefits for affected clans and communities.

FPIC implementation is being tracked by phase and by clan/community and is approximately 85 percent complete as of July 2026. In the Southern PAoI, FPIC MOUs have been developed with Lai-Uhe 1 and Lai-Uhe 2 communities, the five clans of Evara, Aivai, Mareke and the seven clans of Ere, with further FPIC meetings continuing with remaining nearshore and onshore clans, including Hepere and other clans along the PER and waterway areas. A signed Jaoho MOU has also been provided as an example of documented FPIC outcomes. The Project maintains FPIC evidence packages and status tracking by clan/community, including engagement records, attendance sheets, meeting minutes, disclosed materials, signed MOUs, land access or compensation agreements, and implementation monitoring records. Ongoing engagement after MOU signature is used to review implementation, disclose Project updates and address material changes through the Management of Change process.

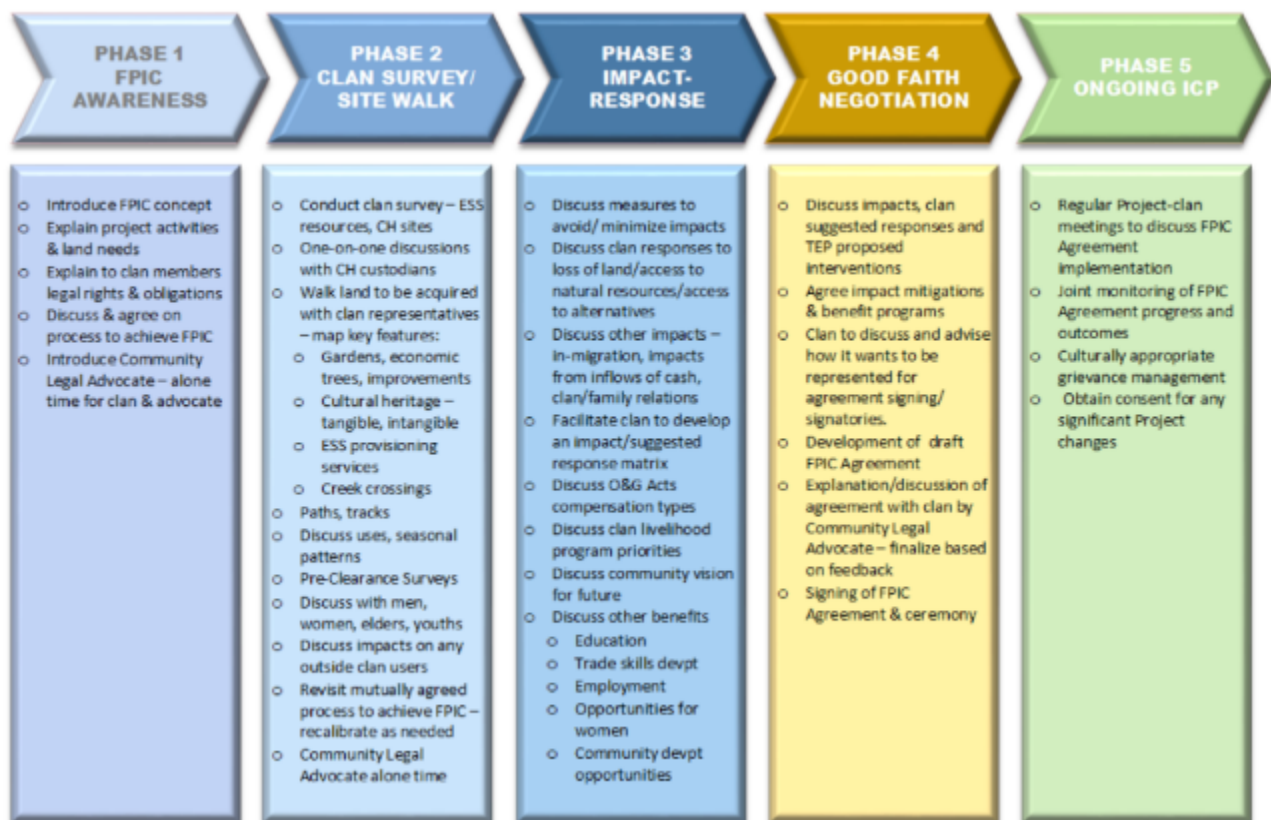


Figure 5-2: FPIC Process. (Source: Indigenous Peoples Framework, 2026, Figure F004)

5.4.5 Representation of Vulnerable Groups and Indigenous Peoples in Consultations to Date

Indigenous communities within the PAoI are core participants in engagement activities, including village-level meetings, clan-based consultations, grievance resolution processes, and FPIC-related discussions.

Engagement records reference consultations across multiple villages and riverine communities, with participation mediated through customary leadership structures, clan representatives, and locally appointed VLOs.

Vulnerable groups (including women and, by implication, households with limited access to services) are acknowledged in the Project's social baseline materials as requiring specific consideration. The Project includes women in consultations and addresses gender-related issues through targeted messaging and programmatic commitments.

5.5 How Engagement is Organised Across the Projects

The Project organises its stakeholder engagement through a structured framework that links engagement planning, implementation, and issue management to Project activities and decision-making. The Project tailors engagement activities to stakeholder type, level of potential impact, and the specific activity underway, and implements them through a combination of routine relationship-based engagement and targeted consultations supporting assessment, permitting, land access, and technical studies.

Stakeholder engagement is integrated with Project planning and decision-making through issue identification, action assignment, design or management response, and feedback to stakeholders, supported by formal issue and grievance management systems.

Engagement planning aligns with the work program through annual and quarterly engagement schedules, intended to support prior disclosure of activities, collection of feedback, and action tracking. There is an established approach to prior disclosure that aims to provide timely and transparent information through culturally appropriate channels and formats that are accessible and understandable to Indigenous Peoples groups and communities. Engagement priorities evolve by phase, including a focus on FPIC processes, land access and livelihoods engagement, and management of PIIM. Engagement is also integrated with other social performance processes, including SMLI, land access negotiations, livelihood planning, and national content discussions.

5.5.1 Integrated Engagement Streams

The Project operates through multiple engagement “streams” that are coordinated as part of the overall approach, including permitting and regulatory engagement; land access and livelihood restoration; technical topic engagement (e.g., biodiversity, water, traffic, emergency response); workforce/worker engagement (including contractors); supply chain/local procurement; and community investment/development planning.

Programmatic engagement is carried out through routine liaison activity with PACs and through established forums, that operate at different levels. The Lida Kibung meetings⁵ are planned to be held as quarterly open forums with PACs (including vulnerable groups) to discuss Project updates, grievances registered, national content, community development, and environmental impacts. There have been 12 meetings held to date, with participation from senior managers of the Project, including the Managing Director.

The Gulf Provincial Working Group provides a complementary forum for provincial-level dialogue on similar topics. These forums have proven to be effective platforms for consultation, alongside routine engagement led by experienced community relations and land access staff supported by the VLO network. The meetings are jointly arranged by the Project and Gulf Provincial Government representatives and are chaired by the Provincial Administrator and Deputy Provincial Administrator.

Impact assessment and disclosure engagement uses participatory methods (e.g., community meetings, focus groups, interviews and workshops) to incorporate local knowledge, validate baseline information, and

⁵ The Lida Kibung meetings are part of Papua LNG’s community engagement framework and provide a platform for direct dialogue with PACs. Participants are encouraged to discuss their concerns, expectations and perspectives on project activities, including environmental surveys, social programs and community development initiatives. They are held on a rotational basis in different communities to ensure broad participation.

discuss potential impacts and mitigation measures. Disclosure content typically includes a Project overview, the structure and findings of the study (including sensitivities and impacts), and an overview of management planning. English and Pidgin versions of executive summaries are distributed to all villages in the Project area of influence listed for that activity.

Project documentation distinguishes between disclosure activities undertaken for different components of the overall development. Upstream disclosure was conducted through roadshows and other consultations (including the EIS Addendum, dredging/barging assessment engagement, fisheries-related consultations, forums, and CLO/VLO activities).

Engagement schedules are prepared to align engagement with work programs and decisions, as well as geographically in accordance with logistic support.

5.5.2 Impact Assessment and Disclosure Engagement

The Project's impact assessment engagement included a mix of village-level meetings, Key Informant Interviews (KIIs), and FGDs, along with further engagement with government, customary landowners, and local communities. The Project does not directly support the National government's royalty allocation and Umbrella Benefits Sharing Agreement and related benefit-sharing arrangements. However, where requested the Project will raise awareness in communities of forthcoming government visits.

In addition to the topic-specific consultations undertaken for the EIS Addendum (2024) and the D&B ESIA (2025), stakeholder engagement has also been used to support FEED-change screening and risk management. The FEED Changes EAR (2025) identifies stakeholder engagement as a core management control for a range of construction-phase change activities, including Purari River dredging, offshore/export pipeline construction, and export pipeline rerouting, and links these activities to the SEMP and related management procedures (e.g., CHSS, traffic/transport, dredging management).

For example, for Purari River dredging, the FEED Changes EAR (2025) identifies direct receptors including Pokore Hamlet, Aivai, Poroi 1, Purari Airstrip House and Kaevaria (short-term disturbance of access to services and natural resources), and also identifies PACs between Herd Base and the mouth of the Purari River (asset loss/damage risk from increased river traffic), with stakeholder engagement specified as part of the management response. The FEED Changes EAR (2025) also identifies export pipeline rerouting as a change driver for engagement with PACs in the Kairuku Rural LLG area.

Since mid-2024, the Project has undertaken targeted consultations linked to updated assessments and design refinements, including:

- Upstream EIS Addendum consultations and roadshows (2024–2025).
- Dredging and barging ESIA consultations along the Purari River and delta (2025).
- Purari River Cultural Heritage Report Ivo Junction, hereafter referred to as CH Report Ivo Junction (2024), including consultations regarding intangible cultural heritage of the PER artisanal waters at Orokolo.
- Integration with FPIC processes, with commitments embedded into land access agreements and Indigenous Peoples planning to support informed community decision-making on heritage treatment.
- Indigenous participation involving elders, women's groups, and youth, supporting mapping, survey design, salvage decisions, and culturally appropriate protocols for graves and sacred sites.
- Fisheries and aquatic livelihoods consultations with riverine and coastal communities (2024–2025).
- Design-change briefings to explain revised layouts, schedules, and mitigation measures.

These engagements focused on validating impacts, clarifying activity locations and timing, and identifying mitigation preferences, with feedback formally logged and tracked through the Project's issue-management and grievance systems.

Stakeholder engagement and disclosure are expected to remain iterative as designs and studies evolve, particularly in relation to updated dredging and barging ESIA results (e.g., number and location of sites, durations, vessel frequency, and disturbance), with associated riverine and cultural heritage considerations to be explicitly addressed within FPIC processes/agreements.

5.5.3 Engagement Timeline

Table 5-3 provides a phase-based chronological summary of key engagement activities undertaken to date. This is not a complete or exhaustive list; records of all engagement activities are maintained in the stakeholder engagement database.

Table 5-3: Stakeholder Engagement Timeline

Period / phase	Engagement topic	Stakeholder Group (s)	Summary of Engagement Activities
2015-ongoing	Early relationship-building starts, ICP and FPIC processes	PACs	- Records show continuous engagement beginning in 2015. - ICP engagement across the PAoI has been occurring since 2015 (i.e., engagement pre-dates recent assessment/disclosure activities).
2015-2019	Community dialogue and consultation for E&S Impact Assessment documents	Potentially Affected Communities; Biodiversity Specialists; national stakeholders, potentially affected communities, local CSOs	Community dialogue and informal interviews with villages, landowners and affected local groups for SMLI, baseline surveys and data collection for environmental, biodiversity and social features of the Project area.
Dec 2019	Submission of EIS for Environmental Permit Application	CEPA	Environment permit application process for the Upstream EIS
Apr 2022	EIS Roadshow and disclosure	PACs, relevant stakeholders	EIS disclosure
2022-2024	Intensified routine engagement, land access, disclosure, biodiversity/ecosystem services and social studies and issue tracking and informing supplementary documentation.	Local landowners, relevant non-governmental organisations, PNG government and educational institutions	- Community census and further baseline data collection (including development of the community directory), supporting FPIC engagement processes for PRL-15 (north) and waterways co-use discussions (south); and early engagement for the D&B ESIA (2025); awareness and development of the BESS and BESAP. - Local NGOs, PNG government and educational institutions consulted where relevant. - Increased engagement activity (Records rise from 1,098 in 2022 to 2,331 in 2023 and 3,293 in 2024) as the Project moved toward FEED-change, FPIC, and development-forum preparation.
Nov 2023-Feb 2024	Dredging and barging SIA engagement	Government Institutions, Local villages and PACs	- Technical Engagement (Government – National and Provincial authorities) - Consultations with local villages; participatory consultation for proposed dredging/barging,

			- river use, food sources, significant sites and expected benefits. - Engagement activities targeted riverine impacts and community input in mitigation.
2024	Submission of EIS Addendum for Environmental Permit Application	CEPA	Addressing substantial changes to the Upstream Project.
2024-2025	EIS Addendum roadshow and disclosure	PACs	EIS Addendum roadshow/public meetings, informal discussions and written submissions/comment boxes in Poroi 1, Poroi 2, Evara and Wabo Station. Communication pack/posters/Q&A discussing EIS Addendum Change in detail such as CPF location change; altered acid gas management.
2025-2026 (ongoing)	ICP/FPIC and LALDP engagement	PACs	- Updates to SMLI studies (including offshore gas and condensate pipeline routes and CPF relocation). - ICP/FPIC documentation records sliding-scale engagement, independent legal advocacy, CLUCA/IPCA processes, FPIC MOUs and ongoing ICP. Rights-based engagement linked to customary land, waterways, natural resources, and cultural heritage.

5.5.4 Ongoing and Planned Activities

Stakeholder engagement is planned to continue across preconstruction, construction and operations, with engagement activities aligned to the work programme and designed to support timely disclosure, feedback collection, issue response, and accountability. The Project prepares annual and quarterly engagement schedules to align engagement with planned activities, disclose upcoming works, gather feedback, and track actions.

Ongoing engagement is intended to maintain regular dialogue at community and provincial levels through established forums as well as routine liaison activity delivered through the Community Relations team and the CLO/VLO network. Engagement will continue to be integrated with key social performance processes, particularly land access negotiations, livelihood planning, and national content discussions, to help ensure that engagement supports both rights/land processes and broader project planning.

As Project activities progress and designs or work scopes are refined, engagement priorities are expected to evolve. Additional consultation will continue to be undertaken in relation to substantial project changes, along with routine engagement with PACs. In parallel, the Project's grievance mechanism is positioned as a core component of ongoing engagement, with performance targets and structured reporting intended to support responsiveness and trend monitoring.

Table 5-4 provides an overview of ongoing engagement activities.

Table 5-4: Ongoing and planned stakeholder engagement activities

Timing / status	Engagement activity	Stakeholder group(s)	Main topic(s) / purpose	Notes
Ongoing (since early development)	Routine engagement via CLO/VLO network	PACs	Relationship management; issue identification; grievance	Core engagement mechanism across all phases

Timing / status	Engagement activity	Stakeholder group(s)	Main topic(s) / purpose	Notes
			awareness; feedback loops	
Ongoing	Community grievance mechanism awareness and intake	Communities; vulnerable groups	Grievance awareness; access to grievance channels; issue resolution	Oral, written, and mediated intake supported
Ongoing	Contractor-coordinated engagement (through Company)	Contractors; communities	Consistent messaging; compliance with Project standards	Contractor engagement coordinated by Company
Ongoing	Government liaison and coordination	National, provincial, district, and LLG authorities	Regulatory updates; permitting; coordination on Project activities	Includes sectoral agencies (e.g., fisheries, environment)
Ongoing	Land access and livelihood-related engagement	Customary landowners; clans; affected households	FPIC processes; land access; compensation; livelihood restoration	Linked to Land Access & Livelihood Framework
Ongoing	Workforce and worker engagement	Workforce; contractors	Worker communications; worker grievance; OHS consultations	Separate but aligned with community engagement
Planned / Pre-activity	Pre-dredging and barging engagement	Waterway and riverine communities	Advance notice of activities; locations and timing; mitigation measures; safety	Commitment to notify communities in advance (e.g., ≥3 weeks)
Planned / Pre-construction	Community health and safety engagement	PACs	Traffic/marine safety; emergency preparedness; workforce influx	Prior to mobilisation and major works
Planned / Phase-specific	FPIC re-confirmation (as required)	Indigenous/customary landowning groups	Re-confirmation of consent where design or scope changes occur	Triggered by footprint or activity changes
Planned / Ongoing	Participatory monitoring engagement	Selected communities; local users	E&S monitoring feedback	As monitoring programs are implemented
Planned / Operations	Performance reporting and feedback sessions	Communities; authorities	Sharing monitoring results; adaptive management	To be implemented during operations
Planned / Closure (if applicable)	Closure and transition engagement	Affected communities; authorities	Early closure planning; livelihood transition; post-closure monitoring	To be initiated well in advance of closure

Timing / status	Engagement activity	Stakeholder group(s)	Main topic(s) / purpose	Notes
Undated / As needed	Incident-related communications	Affected communities; authorities	Incident notification; corrective actions; follow-up	Triggered by incidents or near-misses
Undated / As needed	Targeted technical topic engagement	Interested stakeholders; CSOs	Biodiversity, fisheries, water, cultural heritage topics	Issue-driven or study-specific

The following table outlines engagement undertaken by the Project for each E&S programme stream.

Table 5-5: Stakeholder engagement by E&S Programme Stream

Theme	Engagement coverage (summary)
Assessment & Management of E&S Risks/Impacts	Scoping and ongoing engagement; disclosure; supporting FEED-change screening and risk management; stakeholder feedback integrated into ESMS/ESMP; monitoring participation; reporting back.
Labor & Working Conditions	Worker engagement mechanisms; contractor communications; worker grievance; OHS consultations; code of conduct roll-out.
Resource Efficiency & Pollution Prevention	Engagement on water sourcing; emissions/noise/dust controls; waste management; monitoring results.
Community Health, Safety & Security	CHS engagement (traffic, emergency response); security arrangements and community interface; SEA/GBV risk communication; incident communications.
Land Acquisition & Involuntary Resettlement	Land access engagement approach; census/survey engagement; entitlement communication; negotiations; livelihood restoration consultations; special measures for vulnerable people.
Biodiversity Conservation	Consultation on species identification; engagement on ecosystem services; access restrictions; mitigation hierarchy; offset discussions; participatory monitoring.
Indigenous Peoples	Identification methods; culturally appropriate engagement; FPIC pathway; benefit streams discussions; Indigenous grievance processes.
Cultural Heritage	Consultation on known heritage; intangible heritage considerations; Survey and Salvage Procedure engagement; access to cultural sites; cultural ceremonies requested by communities.

Engagement by Project Phase

For the forward program, engagement planning will be focused on upcoming milestones, with annual and quarterly schedules aligned to the work program. The next 12–24 months' engagement planning can be framed around the following phase-linked priorities:

- **Permitting and regulatory engagement:** continued engagement with relevant regulators and government stakeholders to seek relevant approvals, to support compliance updates and to maintain effective communication.
- **Land access and livelihoods engagement:** continued consultation linked to land access processes, livelihood planning, and related community agreements.

- **Mobilisation and construction readiness:** advance notification of works, reinforcement of grievance access, and liaison activities to manage emerging concerns and expectations as activity intensity increases.

Table 5-6 outlines engagement at each Project Phase. In addition to the structured engagement activities summarised below, the Project has undertaken a range of targeted field-based missions to support the development of the Community Directory (including profiling of all PAoI communities), extensive land access engagement, ground-truthing, and dispute resolution efforts where feasible. These engagements have also supported the delivery of technical and enabling programs, including the Early Works & Infrastructure (EW&I) package and geotechnical investigations, and represent a significant component of broader engagement beyond formal forums and disclosure events.

Table 5-6: Stakeholder Engagement undertaken for each Project Phase

Project phase	Typical engagement expectations	Scope
Early development / siting	Early disclosure; alternatives; PAoI definition; stakeholder mapping; initial concerns.	Early disclosure and stakeholder identification undertaken; initial concerns captured through early consultations and routine liaison.
Scoping / baseline	Baseline participation; access permissions; community knowledge integration.	Community participation supported baseline studies; access permissions sought; local knowledge integrated through consultations/interviews.
Impact assessment & ESMP design	Validation of impacts; mitigation preferences; monitoring locations.	Impacts and proposed mitigations discussed with communities; preferences recorded; monitoring topics/locations discussed through engagement.
Disclosure / consultation	Disclosure events; feedback capture; response-to-comments.	Disclosure events and consultations undertaken; feedback documented; responses/clarifications provided back to stakeholders (where applicable).
Permitting / land acquisition / resettlement planning	Negotiated processes; eligibility; entitlements; consultations.	Land access and agreement-making engagement conducted; eligibility/entitlements discussed as relevant; consultations supported negotiations and planning.
Pre-construction & mobilisation	Traffic plans; CHS; workforce influx management; emergency preparedness.	Targeted engagement on CHS topics (e.g., traffic/marine safety), workforce influx/PIIM considerations, and preparedness messaging prior to mobilisation.
Upcoming / Future		
Construction	Ongoing updates; incident communication; grievance responsiveness; monitoring feedback.	Regular updates delivered via liaison network/forums; incident-related communications as needed; grievances received and managed; business and employment opportunities communicated to local stakeholders; monitoring feedback captured.
Operations	Performance reporting; monitoring participation; adaptive management.	Commitments include ongoing reporting and engagement; business and employment opportunities communicated to local stakeholders; participation in monitoring and feedback loops to support adaptive management (as operations progress).
Closure	Early planning; livelihood transition; post-closure monitoring (if relevant).	Closure engagement to be initiated early if/when applicable, including livelihood transition planning and any post-closure monitoring communications.

5.6 Issues Raised and Outcomes

The Project considers stakeholder concerns as early indicators of community sentiment, emerging risks, and potential tension. Stakeholder feedback has informed:

- Refinements to project design and activity sequencing
- Updates to mitigation measures and management plans
- Improvements to disclosure practices
- Enhancements to grievance procedures and awareness.

Where stakeholder requests cannot be accommodated, the rationale for decisions is communicated back to them, as part of an iterative feedback loop supported by routine engagement and liaison activities. Table 5-7 provides a summary of the key issues raised by stakeholders.

Table 5-7: Summary of Stakeholder Issues Raised

Issue theme raised by stakeholders	Details and analysis derived from engagement records
River traffic, vessel wake, canoe safety and riverbank erosion	Dredging/barging consultations record concerns about vessel wake, barriers to canoe travel, erosion, and emergency help. Grievance analysis shows economic-loss and safety grievances are prominent, with recent narratives often linked to vessel backwash, damaged nets or capsized canoes. These concerns informed river transport and marine traffic management, advance activity notifications, safety messaging, monitoring of vessel-related incidents, and investigation/close-out through the grievance mechanism.
Water quality, drinking water and sago/fisheries impacts	Aivai, Poroi 1, Subu 1, Subu 2 and Wabo consultations recorded requests for water tanks, concern over muddy water, fish movement, prawns, sago washing and dredging locations. These inputs informed pre-dredging consultation, disclosure of dredging locations/timing, targeted mitigation, discussions on water access and fisheries, and monitoring commitments.
Land access, compensation, livelihood restoration and customary ownership	Land and resettlement matters are a recurring theme within ICP/FPIC documents, CLUCA/IPCA, compensation discussions, LALDP links aligned with a sliding-scale engagement approach. Land and livelihood concerns are managed through land access processes, FPIC/ICP engagement, compensation agreements, LALDP participation, and ongoing grievance channels.
Cultural heritage and culturally sensitive sites	Engagement history records cultural heritage consultations, oral histories, participatory mapping and confidentiality concerns. ICP/FPIC documents require engagement where cultural heritage and customary resources may be affected. Cultural heritage feedback is used to inform survey, salvage, avoidance/mitigation, confidentiality controls and ongoing engagement with custodians and elders.
Employment, procurement, benefits and community development expectations	Subject categories include employment and supply chain and social investment projects; EIS Addendum roadshow comments include training, local business, infrastructure and services requests. These matters are managed through national content, community investment/development planning and continued feedback to align expectations with Project commitments and opportunities.
Communication quality, access to information and feedback loops	Records 4,094 toll-free contacts; D&B consultations requested radios, noticeboards, maps and clearer location information; disclosure documents identify newsletters, toll-free lines, VLOs and accessible formats.

Issue theme raised by stakeholders	Details and analysis derived from engagement records
	Feedback has led to continued use of local-language engagement, VLO/CLO visits, toll-free access, newsletters/materials, comment boxes and clearer pre-activity disclosure.
Vulnerable groups, women, youth and low-literacy stakeholders	Grievance procedure provides oral intake and witness signatures for low-literacy complainants; ICP/FPIC documents promote broad-based participation including women, youth and vulnerable people; disclosure approach includes resident male/female VLOs. Engagement is adapted through oral submissions, gender-sensitive channels, male/female VLO representation, confidentiality safeguards and accessible materials.

5.7 Grievance Mechanism and Issue Management

The Project operates a CGP, to receive, acknowledge, assess, and resolve concerns and grievances related to Project activities. There are separate mechanisms for community and workforce grievances, reflecting different legal and operational contexts, while applying aligned principles, standards of response, and documentation requirements across both systems.

The stakeholder engagement database export reviewed for this ESHIA Synthesis contains 150 community grievance records received between 9 August 2015 and 23 April 2026. All 150 are marked closed. The grievance profile is dominated by economic-loss grievances (98 records, 65.3%), followed by safety (28 records, 18.7%) and land related grievances (16 records, 10.7%). This pattern is consistent with the issues raised during engagement, particularly river use, vessel wake, damage to fishing gear/canoes, livelihood effects, land access and compensation.

5.7.1 Scope & Application

The CGP applies to all community concerns and grievances arising from Project activities, including issues raised during routine engagement, consultations, and Project operations. Concerns raised through engagement (for example via CLOs or VLOs) are treated as part of the CGP system, recorded in the stakeholder engagement database, and tracked through to response or closure where required.

The mechanism includes provisions for:

- Awareness-raising and disclosure of grievance channels
- Defined process steps and timeframes
- Escalation and committee review where required
- Systematic documentation and reporting.

The CGP excludes employee and contractor grievances (addressed through a separate worker grievance mechanism), as well as legal proceedings, criminal matters, and complaints unrelated to the Project.

5.7.2 Effectiveness Criteria

The CGP is designed in alignment with internationally recognised effectiveness criteria for non-judicial grievance mechanisms. In particular, the mechanism is intended to be legitimate, accessible, predictable, equitable, transparent, rights-compatible, participatory, and supportive of continuous learning.

These criteria are operationalised through:

- **Multiple entry points for submitting concerns**, including CGP boxes in communities, a toll-free hotline, direct communication with CLOs and VLOs, written submissions, and grievance awareness sessions.

- **Culturally appropriate engagement**, supported by locally based CLOs and VLOs, multilingual grievance brochures, and oral as well as written grievance submission options to address literacy and language barriers.
- **Protection from retaliation**, with procedures requiring confidentiality, respectful handling, and escalation of sensitive grievances.
- **Predictable timeframes**, supported by defined acknowledgment and resolution targets.
- **Transparency and accountability**, through documentation in the stakeholder engagement database and committee (see Section 5.7.4) oversight of escalated grievances.

The Project promotes awareness of the CGP through regular engagement activities, induction and refresher training for staff, and distribution of grievance materials across PACs.

5.7.3 Grievance Categories and Process

The CGP defines a set of grievance categories that reflect the recurrent types of concerns raised by communities through engagement and grievance channels. These categories include:

- Land access, land acquisition and resettlement
- Economic loss and livelihood impacts
- Employment and supply chain concerns
- Environmental impacts and community health and safety
- Social behaviour and security conduct
- Cultural heritage impact;
- Social investment and community development
- Engagement and communication quality.

The grievance process follows defined steps for grievances, including receipt, registration, acknowledgment, evaluation, investigation, resolution, escalation (where required), and close-out. Escalation pathways are triggered for grievances that cannot be resolved at the operational level or that present heightened risk or complexity.

5.7.4 Roles, Capacity, and Oversight

Implementation of the CGP is coordinated by a nominated Coordinator, responsible for overall administration of the mechanism, management of the stakeholder engagement database, coordination across departments, and tracking of actions and resolutions.

Two formal committees support oversight and escalation:

- **On-Site Grievance Committee (OGC)**, which reviews grievances requiring cross-functional input or operational decision-making.
- **Social Steering Committee (SSC)**, which provides higher-level review of escalated or sensitive grievances and supports timely resolution.

All relevant personnel involved in engagement and grievance handling receive induction and refresher training, covering respectful engagement, grievance intake and recording, investigation procedures, risk assessment, escalation requirements, and the stakeholder engagement database use.

The Project has established performance targets for CGP, including:

- Acknowledgment of 80% of grievances within 7 days and 100% within 14 days
- Closure of 100% of rapid-resolution grievances within 30 days, with escalated grievances addressed within defined escalation timeframes.

Monthly, quarterly, and annual reporting tracks grievance volumes, categories, severity, response times, trends, and recurring issues. Monitoring is used to assess mechanism effectiveness, compliance with procedural timeframes, and emerging social risks that may require management response or changes to engagement approaches.

Going forward, the Project aims to strengthen systematic reporting back to communities and stakeholders on grievance trends and outcomes, as part of ongoing improvement of transparency and accountability.

5.8 Effectiveness Evaluation and Assurance

The Project's stakeholder engagement and grievance systems are designed to be systematic, traceable, and auditable, with monitoring and assurance expectations embedded in the tiered engagement framework. The SEMP (2023) includes monitoring and audit requirements, alongside defined roles, responsibilities, training, and documentation expectations. Structured data management through the stakeholder engagement database allows the Project to review engagement coverage, issues raised, actions assigned, and close-out.

Stakeholder feedback and concerns are treated as signals of emerging risks and community sentiment, and are used to refine Project practices, including improvements to disclosure and grievance processes. In the grievance system specifically, recent improvements include additional training for liaison officers, refresher sessions for the OGC, and improved digital recordkeeping. The Project also aims to strengthen the way consultation outcomes are consolidated and reported, as part of continuous improvement and transparency.

Stakeholder engagement and grievance management are monitored through a combination of engagement records, grievance data, reporting outputs, and community feedback mechanisms. Table 5-8 summarises the main monitoring focus areas, indicative indicators and evidence sources, and the way these information streams are used to support reporting, feedback to affected communities and continuous improvement.

Table 5-8: Stakeholder Engagement Effectiveness Monitoring and Reporting

Monitoring focus	Indicative indicators / evidence	Reporting and feedback use
Engagement delivery	Number of engagements; geographic coverage; stakeholder groups reached; gender and vulnerable-group participation where recorded; engagement topics; communication channels; engagement plan/programme coverage.	Used to confirm whether engagement is reaching affected communities and relevant stakeholder groups at the right frequency, scale, and format.
Project responsiveness	Issues raised; actions assigned; close-out status; grievance acknowledgement and closure timeframes; grievance type and location trends; evidence of feedback to stakeholders.	Used to assess whether stakeholder concerns are being tracked, acted on, closed out, and reported back through appropriate channels.
Stakeholder engagement Database evidence base	Full engagement and grievance dataset, including annual trends, location coverage, communication types, subject categories, grievance categories and closure performance.	Used as the primary evidence base for periodic engagement and grievance reporting, rather than relying only on selected meeting examples.
Community-facing reporting	Summary of what was heard, what the Project did in response, issues remaining open, and reasons where concerns could not be accommodated.	Used to close the feedback loop with affected stakeholders and support transparency and continuous improvement.

Management and forum reporting	Weekly grievance dashboards to Project management; quarterly and annual monitoring reports; feedback through community forums, including Lida Kibung meetings.	Used to connect internal grievance oversight with community-level reporting on grievance management, outcomes, and lessons learned.
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6 Baseline, Impact Assessment and Mitigations

6.1 Major Hazards and Infrastructure and Process Safety

6.1.1 Introduction

This section presents a synthesis of Project documentation relating to major hazards and infrastructure process safety. The LNG industry has been well established worldwide over many years, and the various major hazards present in gas production, LNG processing and export have been well defined. The definition of a major hazard is a source of danger that has the potential to cause a major incident, whether that involves multiple fatalities and/or major damage to plant, equipment or the environment.

Major hazards are associated with very low likelihood accidental, upset or abnormal events. These are essentially unplanned impacts, to be anticipated as possibilities, for which preventative actions and reactive responses are embedded in Project design and operating processes.

This section includes a reference to the various major hazards that will pose a risk of major injury or fatality to onsite personnel who will be present during construction and operations, and off-site populations. The mitigation measures are described for prevention of a major accident, and management control in the unlikely event that a major accident should occur. It is the mitigation measures that are key to the level of process safety to ensure that the risk to people and to the environment can be considered broadly acceptable, or As Low As Reasonably Practicable (ALARP).

Although, the likelihood of major accidents is low, the fact that these can result in high consequences, such as multiple fatalities, means that major hazards and the risk of these must be managed accordingly.

6.1.2 Baseline

In a major hazards and risk assessment study, the key receptors are the onsite personnel and any nearby offsite population groups, who have the potential for major injuries and fatalities in the unlikely event of a major accident occurring. Damage to the local environment from major accidents is also considered, although most major accidents will have impacts within the facility boundaries. An exception to this is the potential release of hazardous fluids from the pipelines, which will have more of a potential impact on the surrounding environment and less on people.

Of the personnel who will be working at the facilities, those most at risk will be the operations and maintenance staff who will be located closer to the equipment that contain the hazardous materials. Personnel that work inside buildings will have protection from flammable events that result in major fires. Explosions, however, can result in catastrophic damage to buildings that are close to the explosion centre.

The methodology for determining the risk to the various population groups is summarised in Figure 6-1 below where the first three steps provide inputs for step four (development of risk reduction measures, ALARP demonstration) and step five (action plan).

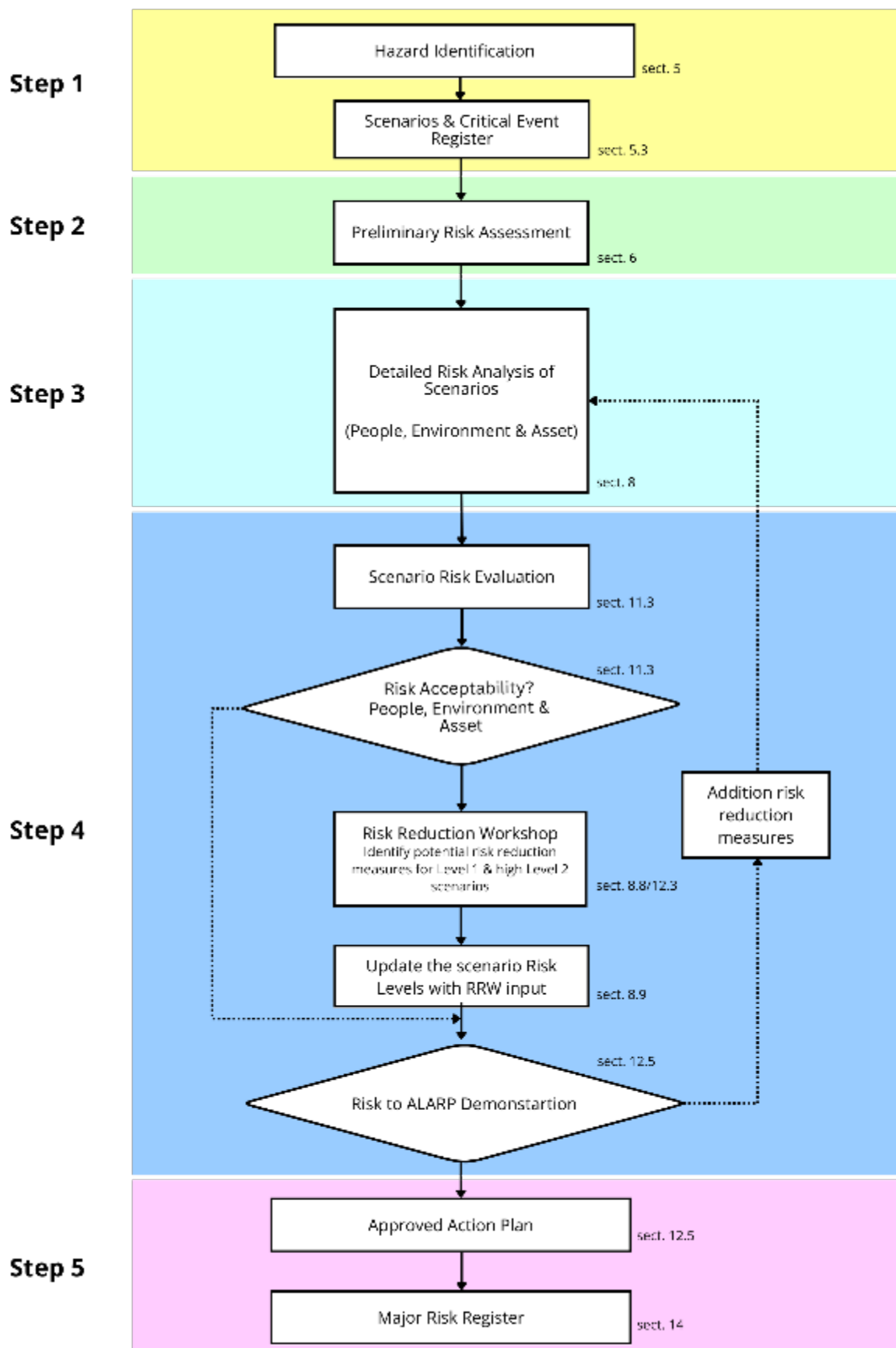


Figure 6-1: Simplified flow-scheme of technological risk management process (Source: CPF & Wellpads Detailed Risk Assessment (DRA) Report (2023))

6.1.3 Impact Assessment

The major hazards have been specified by the Project within the HAZID procedure and include jet fires, pool fires, flash fires and explosions of the various highly flammable materials involved throughout the process.

The purpose of the HAZID mentioned in the EIS (2019) was:

- To identify the hazards and associated risks that can impact infrastructure design.
- To identify the major hazards and put in place robust measures / preventative barriers and corrective actions.
- Where necessary, propose recommendations to:
 - Better analyse the hazard and associated risks (e.g. collect more input data or carry out specific studies).
 - Consider the implementation of additional barriers or alternatives.

The following major hazards regarding process safety have been considered at wells and wellpads, the CPF, pipelines and export pipelines, and transport routes:

- Fire during well drilling or operations.
- Loss of well control during well drilling or operations, potentially resulting in a blowout.
- Release of high levels of H₂S gas due to equipment failure.
- Fire or explosion of gaseous or liquid hydrocarbons from pipelines or during processing at the CPF.
- Seismic events damaging pipelines and processing facilities at the CPF causing a large-scale hazardous material release.
- Fuel spills due to rupture of a vessel bunker or bulk fuel and chemical containers.

A hazard analysis (HAZAN) was also carried out to evaluate safety distance requirements by conducting consequence analyses to determine the extent of the potential harmful effects of the major hazards on people.

The gas to be produced is sour due to H₂S (Antelope: 120-210 ppm H₂S, Elk: 5 ppm H₂S), but is not fatal at these H₂S concentrations. The US Occupational Safety and Health Administration (OSHA) provide the following at 200 to 300 ppm: *Marked conjunctivitis and respiratory tract irritation after 1 hour. Pulmonary oedema may occur from prolonged exposure (according to the [United States Department of Labor Occupational Safety and Health Administration website](#)).* The concentration of the H₂S within the atmosphere will reduce rapidly upon accidental release due to the turbulent mixing with air, such that the concentration of exposure to workers would be much reduced from the maximum of 210 ppm.

Hazard and Operability Studies (HAZOPs) have been carried out using the Piping and Instrumentation Diagrams (P&IDs) mentioned in CPF & Wellpads Technological Risk Assessment (TRA) Action Plan & Risk Register (2023), hereafter referred to as CPF & Wellpads TRA Plan (2023). HAZOP is a structured and systematic examination of a system in order to identify hazards to personnel, equipment or the environment, as well as potential operability problems. It is generally considered the foremost hazard identification tool within process safety that has become a standard method in process design. The intention is to systematically and methodically review the design to identify design and engineering issues that may otherwise not have been found. It is carried out by a suitably experienced multi-disciplinary team during a series of meetings, who will determine the potential consequences and likelihoods of identified hazards. Where the team determines that the risk of an identified hazard is potentially high (either due to extreme consequence or high likelihoods, or both), the team may recommend potential risk reducing

measures if they feel that the existing measures are insufficient to address the risk level. In this way the risk is reduced to a level that is considered acceptable or at least ALARP.

Various risk assessments have been conducted, and these are embedded into the Project design to ensure that appropriate mitigation measures are in place to address the likelihood and the consequences of major hazards.

These risk assessments have included consequence modelling of the various major hazards that have been identified, using state-of-the-art models, and the following main outcomes have been determined:

- Both the CPF & Wellpads Detailed Risk Assessment (DRA) Report (2023), and CPF & Wellpads Quantitative Risk Assessment (QRA) Report (2023), show that the principal risk contributors with regard to personnel arise from potential loss of containment cases at:
 - The CPF
 - Receiving Facilities Inlet Separator
 - Feed Gas Knock-out Drum / Coalescer / Amine Absorber
 - Low Temperature Separator
 - Gas to LNG Plant via Export Pipeline.
- Regarding the condensate pipeline, the decision whether to install a subsea isolation valve (SSIV) was reviewed and it was deemed that the current design (no SSIV) is ALARP.

The risk analyses have been conducted based on the marked-up P&IDs used in the HAZOP review, and hence were the most up-to-date engineering details available at that time. The potential changes in the isolatable sections, parts counts and risk mapping will be implemented / updated during the EPC phase.

6.1.4 Mitigation

As stated above, the LNG industry has been well established worldwide over many years and this includes the various mitigation requirements for inherent safety, and prevention and control of accidents. A Project Safety Concept (EIS, 2019) has been developed that defines the basis for the specific safety engineering requirements to be adopted for the Project design, so that facilities are designed to a recognised safety standard, and the systems required to protect personnel, the environment and Project assets from the identified hazards are provided.

The Project Safety Concept establishes the measures to:

- Avoid or limit exposure to potential hazards.
- Minimise the potential (frequency) for hazardous occurrences.
- Contain and minimise the consequences of an incident.
- Provide the means of escape and evacuation for personnel from an incident.

The mitigation measures for major hazards are outlined in Table 6-1.

Table 6-1: Management measures - Major hazards

Impact	Mitigation code (As in MP)	Description	Source document
Major Hazard Risks at Wellpads and CPF	SM018	Restrict community access to Project sites.	<i>EIS/ Upstream CESMP; 2019</i>
Drainage and Bunding	ED015	The CPF will have an open drain system to manage rainwater; the system will have three separate networks: OD1 = permanently hydrocarbon-contaminated drains. OD2 = accidentally hydrocarbon-contaminated drains. OD3 = hydrocarbon-free drains. Water from each system will be treated separately and discharged to the environment according to applicable limits.	<i>EIS/ Upstream CESMP; 2019</i>
Blowout Contingency Planning	EM018	An Emergency Response Plan will be developed to effectively manage the preparedness and response to emergency events. It will contain: • Site Contingency Plans, that will consider fire management measures. • An Oil Spill Contingency Plan, that will consider spill risks for construction, operation and decommissioning of facilities and associated infrastructure, and supply services on land and in aquatic and marine environments. • A Blow Out Contingency Plan including well blowout control and contingency measures	<i>EIS/ Upstream CESMP; 2019</i>
Geohazards, Leachate and Spills	ED005	The landfill will be designed to comply with TotalEnergies' general specification for landfills, and will be designed, located, constructed and operated in general accordance with the intent of the Code of Practice for Sanitary Landfill Sites (DEC, 2001) and other applicable standard industry practices.	<i>EIS/ Upstream CESMP; 2019</i>
	ED006	Minimise chemical use and select chemicals considering the following criteria: • lowest toxicity, lowest bioaccumulation potential and highest biodegradation; • chemicals subject to bans or phase-outs.	<i>EIS/ Upstream CESMP; 2019</i>
Stakeholder Engagement	SM016	In consultation with relevant stakeholders, develop a community emergency preparedness and response policy and procedure that clearly define roles of stakeholders in the event of Project-related emergencies or accidents affecting the community.	<i>EIS/ Upstream CESMP; 2019</i>

With risk mitigation measures applied and no high-risk scenarios, such that the risks are at most “tolerable if ALARP”, some residual risks must be managed to ensure that they remain at this level by well-defined safety management systems throughout the Project lifecycle.

Even with good risk management and safety management systems, there remains a residual risk of hazardous releases from the process. In this respect, TEP PNG has a Project Emergency Response Plan (ERP), that provides a systematic approach to managing incidents and emergencies. It is based on a risk assessment process that identifies potential credible emergency scenarios.

The Project ERP is reviewed regularly and will be updated as needed to include the following:

- Description of the emergency response team organisation (e.g. structure, roles, responsibilities and decision makers).
- Elements for managing emergency scenarios, with contact details for relevant personnel.
- Description of response procedures (e.g. details of response equipment and location, procedures, training requirements and duties) for major accident hazards such as major spills, fires and explosions, loss of well control.

Exercises in emergency preparedness are and will continue to be practiced regularly, which is a key requisite in ensuring that the ERP will be effective should a real incident occur.

With regard to the local community, the Project ERP takes into account how it can be affected. There is a Community Relations Officer, who provides support to the community through a number of mechanisms, as described in the ERP, for example:

- Brings community relations expertise to general and emergency response staff as required.
- Ensures appropriate communication with communities and acts as focal point as required, with the support of the site's community relations personnel.
- Ensures appropriate care of any impacted communities.
- Attends meetings and briefings as required to help resolve community relations issues.

It is noted that the Affiliate ERP (2023) provides many of the required details for community issues but it needs to be operationalised for community-level implementation that clearly sets out how communities will be involved in planning for emergency response scenarios that could impact them. There is an action to prepare and provide a procedure including details on how communities will be sensitised, trained, and supported to understand potential emergency situations and the responses required. A Community Health Safety and Security Management Plan is also under development.

The Oil Spill Contingency Plan (OSCP) is discussed in Section 6.1.6.

A Blowout Contingency Plan (BOCP) will also be in place to address risks of well blowout. The following embedded design controls address this risk:

- The well design and construction process selected adhere to:
 - o The industry best practices, standard such as the double well barrier principle at any time
 - o TEP PNG referential to mitigate the likelihood of occurrence to a very low probability.
- A TRA is performed to ensure all the required mitigations will be in place to bring the risk to an acceptable level.
- Due to the specific risks associated to the fractured/karstified gas reservoir, the complexity of blow out intervention in this remote area requires some additional, non-standard mitigation measures such as:

- o Pressure mud cap drilling technique for the reservoir section drilling.
- o Downhole deployment valve for tripping safely the bottom hole assemblies during the reservoir sections.
- o Kinetic blow out stopper to be added to the standard blow out equipment. This allows the closing of the well in any circumstance.

A BOCF is already in place for the legacy wells and will be updated with the additional studies performed for the development wells such as:

- Potential blow out rate study
- Well capping & dynamic kill study
- Relief well feasibility studies An OSCP will be in place to address oil spills in the case of well blow out.

6.1.5 Residual Impacts

The technical approach for identification and assessment of major hazards associated with infrastructure and process safety is well advanced and includes the HAZID, HAZAN and HAZOPS as outlined in the sections above. These procedures focus on tolerability of risk and the application of ALARP.

More particularly:

- With risk reduction measures in place, there were no intolerable risks identified at the CPF.
- The potential risk to local communities from the CPF and the onshore pipelines has been addressed, and this has been demonstrated to be low and defined as 'Broadly Acceptable' by the Project risk criteria.
- With risk reduction measures in place, there were no intolerable onshore environment risks identified for the Project.
- For the offshore pipelines, there is no risk of disastrous environmental consequences or intolerable risks given implementation of relevant risk reduction.

As outlined above and shown in the source documents, these evaluations have determined that risks posed due to major hazards related to infrastructure and process safety considering the proposed risk reduction measures are tolerable, and ALARP.

6.1.6 Unplanned and Non-Routine Events: Spills and Loss of Containment to Surface Water and Soils

Introduction

This section addresses the management of unplanned spills and loss of containment affecting surface water and soils during construction, operation, and decommissioning. It complements Section 6.1 on major hazards and safety process, by specifically addressing environmental pathways, surface water and soil receptors, and the spill management systems applied at the Project level. Spill management applies across all relevant Project components, including:

- CPF and wellpads
- Onshore pipelines
- Offshore pipelines
- Early works and infrastructure

- Logistics activities
- Herd Base operations.

Baseline

Regarding environmental receptors, surface water bodies include rivers (notably the Purari), wetlands, coastal zones, nearshore marine habitats, mangroves, coral reefs, and fisheries. As per the FEED Changes EAR (2025), marine waters in the PAoI are considered of medium sensitivity.

Soils along the pipeline RoW and around construction sites are susceptible to contamination, particularly in areas of soft sediments, low permeability, or hydrologically connected terrain.

Potential spill sources to soil and surface water vary across the Project lifecycle and include:

- Bulk fuel and waste oil storage, where loss of containment may occur during transfer operations, bunkering, vessel incidents, tanker failure, or storage infrastructure failure. Hazardous bulk liquids will include aviation fuel, marine diesel, diesel for plant and vehicles, and bulk waste oil storage.
- Construction activities, particularly HDD in Caution Bay and potentially the Purari River area, where loss of drilling fluid may occur if HDD mud breaks through geotechnically weak zones.
- Pipeline systems (onshore and offshore), with potential leaks or ruptures resulting in release of condensate or diesel to inland or marine environments. This includes scenarios modelled in the Pipeline Systems Offshore Environmental Risk Assessment, hereafter referred to Pipeline Systems Offshore ERA (2025).

Impact Assessment

The Project has evaluated potential impacts of the major spill scenarios, such as a large release of liquid hydrocarbons from a pipeline leak onshore or offshore.

Impacts are mainly derived from the interaction between oil spill sensitivity mapping and spill drift evaluation. This includes modelling of potential spreads of pollutants against sensitive E&S receptors, to determine:

- 1) If sensitive areas could be impacted
- 2) If “yes”, when, and by how much, and
- 3) Which strategies to consider for the response in case of accidental release.

Modelling is based either on topographic features for the inland related scenarios, and on metocean data (winds, currents) available for offshore related scenarios. A typical modelling process for inland accidental releases consists of evaluating some key locations and the effect of topography on the direction, speed and spreading of the propagation of the pollutant on the ground over time.

To complement existing studies on field development activities, an onshore ERA (Pipeline Systems Onshore Environmental Risk Assessment, hereafter referred to Pipeline Systems Onshore ERA (2025)) has been conducted in May 2025, focusing specifically on the pipeline RoW. Along the pipeline trajectory eight locations were considered for the study, based on the sensitivity of potential receiving environment, which includes the Purari River. Three scenarios have been considered:

- Full rupture and 80mm leak
- 20mm leak
- 5mm leak

During the construction phase of the Project, the following potential impacts from spills and loss of containment have been identified:

- Fuel and waste oil spills, where loss of containment may contaminate soils, enter drainage pathways, or affect surface waters. Impacts include temporary reduction in water quality and localised toxicity to aquatic and riparian habitats.
- HDD drilling fluid releases, which, based on geotechnical studies, are most likely to be small in volume and composed of biodegradable, water-based muds. Impacts would be very localised (typically <500 m) and short term in bottom waters and sediments.

During the operational phase of the Project, the following potential impacts from spills and loss of containment have been identified:

- Loss of containment at CPF or wellpads, although operational risk assessments indicate that containment systems (bunds, drainage systems) largely reduce the likelihood of releases reaching external receptors; at wellpads, liquids would flash off upon exposure and not accumulate on soil surfaces.
- Pipeline leaks, assessed through modelling across three offshore spill points and multiple onshore spill points, with scenarios showing potential impacts to mangroves, prawn fisheries, turtles, lobster spawning products, and coral reefs depending on leak severity and duration.

The modelling described above found that bore rupture scenarios result in spill of 65–92 tonnes of hydrocarbons over one day. 5 mm leak scenarios spill 1,523–2,278 tonnes over one month.

Initial modelling (not with risk mitigation measures included) identified catastrophic red risk impacts for some mangrove areas (including Vailala, Kerema and Manugoro) in the event of prolonged leaks, prior to implementation of risk reduction measures. Updated modelling based on reduced leak duration (e.g. from one month to approximately 1.5 days through enhanced leak detection/fiscal metering) shows removal of disastrous risk for mangrove and substantial reduction in fisheries closure area.

During the decommissioning phase, potential impacts are similar to construction: spills from dismantling operations, equipment removal, fluid handling, and potential disturbance of contaminated soils.

Mitigation

Mitigation includes preventative measures, preparedness measures, and tiered response strategies, drawing on the structured spill contingency planning framework.

As part of the Project's ERP, an OSCP has been prepared for recent, ongoing or short-term drilling activities and will be updated to cover all activities related to the Project, in line with applicable requirements (including national/local regulations) and guidelines related to spill preparedness and response. The OSCP allows the Project to:

- Identify the important organisational and operational points to be taken into consideration in the response effort, in particular for the first actions
- Ensure that the response effort deployed is the most suitable to the types, levels and possible evolution of the pollution,
- Mitigate the consequences of the accidental release.

Mitigation measures that will be applied by the Project are presented in the Table 6-2 below:

Table 6-2: Mitigation measures - Spill and loss of containment

Impact	Mitigation code (As in MP)	Description	Source document
Storage, use, transport and disposal of hazardous materials.	ED003	Adopt standard industry practices to prevent and protect against soil/water contamination, due to Project activities, such as: - Preparing hydrocarbon and chemical management procedures, as part of the Hazardous Materials Management Plan. - Building infrastructure on impervious surfaces where required. - Providing permanent fuel and chemical stores, and maintenance and refuelling areas with secondary containment of an appropriate volume to prevent loss to the environment or mixing with incompatible materials. - Installing interceptor pits or similar to collect contaminated surface water runoff and treat where required. - Installing tanks above ground with impermeable liners and bunds around tanks. - Regularly inspect and maintain the containers, storage and transfer infrastructure to prevent/control spills or leaks. - Installing readily accessible spill kits and training staff in their use. - Appropriately treating and disposing of any accidentally contaminated soils.	<i>EIS/ Upstream CESM. 2019P</i>
	ED006	Minimise chemical use and select chemicals considering the following criteria: - lowest toxicity, lowest bioaccumulation potential and highest biodegradation. - chemicals subject to bans or phase-outs.	<i>EIS/ Upstream CESM. 2019P</i>
	ED021	Requirements for hazardous material transfer, overfill protection, and alarms will be implemented, e.g.: - Using dedicated fittings, pipes, and hoses specific to materials in tanks. - Providing secondary containment, drip trays, etc. at connection points or other possible overflow points. - Using dripless hose connections for vehicle tank and fixed connections with storage tanks.	<i>EIS/ Upstream CESM. 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		• Providing automatic fill shutoff valves on storage tanks to prevent overfilling. • Using piping connections with automatic overfill protection (float valve). • Fitting tanks with high-level alarms with both audible and visible annunciation.	
Drilling fluid	TBC	For Caution Bay shore crossing by HDD, additional mitigation measures have been identified. Specifically, the risk of occurrence of frac outs during HDD will be minimised by: • Conducting detailed geotechnical investigations to understand ground conditions along bore path to inform assessment of the risk of frac out and avoid paths in weak zones. • Installing casing at the entry point where reduced cover and bearing pressure exists. • Continual monitoring of drilling fluid pressures and losses during drilling and if unexpected variations or trends are observed cease drilling, investigate causes and implement remedial measures.	<i>FEED Changes EAR; 2025</i>

The OSCP covers all activities related to the Project, and considers leakages of liquid hydrocarbons such as condensate, jet A1, diesel, heavy fuel oil, chemicals, if used in large quantities. The OSCP is prepared and organised to provide the useful and necessary information and guidance documents when activated for:

- The personnel in charge of operations on the site of the spill
- The personnel involved in the Advanced Command Centre (or On-site Command Post)
- The personnel involved in the affiliate Headquarters emergency cells
- The personnel potentially involved from TotalEnergies headquarters (France)
- The personnel involved from third parties organisations such as Oil Spill Response Limited.

All scenarios will be considered, with a specific focus on major accidental releases, of condensate or diesel, for establishing the appropriate response:

- inland response, including if the pollutant reaches the river or coastal areas
- response at sea to monitor and limit the spreading of pollutant
- to treat the spillage the closest to the source, anticipation of a response close to the coast
- for protective actions and coastal cleanup/remediation actions.

Potential regional or international coordination of responses will be looked at.

For instance, for a subsea release of condensate from a pipeline damage away from the coast, one anticipated significant offshore scenario for the Project, the strategy will address the spill from the source to the potential impacted areas through several response barriers:

- As a first barrier, together with the effort to control the source (closing the pipeline section and repairing the breach) vessels will have been mobilised from the detection of the leakage, to deploy appropriate offshore response.
- As a second barrier, a coastal response will be considered, through vessels of opportunity, to confine and recover residual pollutant not treated by the first barrier; this barrier will be sized to minimise impacts to sensitive coastal resources, following pollutants weathering and drift modelling studies results.
- In advance, most sensitive sites identified during the preparation of the OSCP will have been protected (protective booms, absorbent booms) following protection plans set up in the early stages of the response, when first observations confirm the actual drift of the spill.
- Ultimately, coastal clean-up will be considered, with the set-up of worksites first focused on most sensitive and early impacted areas.

For an accidental release onshore, the strategy will consist of:

- Preventative measures in civil works that allow for early containment in case of a wellpad blowout (berms, protected pits, etc).
- In all cases, identify natural containment points using topography and drainage modelling.

Residual Impacts

With the measures above in place, spills during construction are expected to be localised and short term. Consistent with the EIS (2019) and FEED Changes EAR (2025), magnitude and sensitivity ratings result in residual significance of minor for marine water quality and marine fauna, and negligible to minor for most species groups. With containment and ERP/OSCP measures applied, impacts to soils and surface waters are of low likelihood and minor to moderate severity depending on material spilled. Regarding pipeline and

process leaks, residual risk is ALARP, with high risk scenarios mitigated through reduced leak durations, enhanced leak detection, and improved response capability. Modelling shows substantial reduction in impacts to mangroves, fisheries, and coastal habitats under revised assumptions. For HDD drilling fluid releases, residual impacts are minor, owing to low toxicity fluids, small potential release volumes, and short duration, highly localised effects on marine water quality and benthic habitats. Across all scenarios, and with the OSCP and associated systems in place, residual impacts to surface water and soils from unplanned spills are assessed as minor, and within the Project's acceptable risk criteria.

6.2 Labour and Working Conditions

6.2.1 Introduction

This section presents a synthesis of the Project approach to managing labour and working conditions (LWC). LWCs relate to the standards and provisions that are implemented for the Project workforce during construction, operation and decommissioning phases. In the context of a remote location, this includes the design and facilities of Project accommodation camps. The IFC PS2 has explicit guidance and expectations relating to the standards within which Project personnel will work.

The scope of this section includes the following:

- Occupational Health and Safety (OHS) and welfare of the project workforce
- Local content employment and retrenchment
- Fair treatment, non-discrimination and equal opportunities
- Protection of workers in vulnerable categories such as youth, women, migrant workers, workers engaged by third parties, and workers in the Project supply chain, including avoiding the use of forced labour
- Identification and communication of the legal obligations and expected standards for contractors' performance
- Provision of healthcare in prevention of infectious disease
- Management of LWC.

At the time of writing, workforce estimates for the Project are provisional and EPC contractors are yet to be appointed. As such the LWC baseline is described in the context of the national and international legislation and guidance. This section therefore provides background to the governance of LWC in PNG, a summary of general LWC in PNG and the workforce requirements for the Project. The section then focuses on the mitigation measures that have been developed to manage LWC for the Project.

6.2.2 Baseline

The following section provides an overview of the governance of LWC in PNG in order to describe the baseline conditions of a typical workforce in PNG.

International Standards

PNG has ratified all ten core ILO Labour Conventions.

The Project is committed to applying these conventions through Company Fundamental Principles of Purchasing (TotalEnergies, 2021).

National Regulations

Regulatory requirements for the Project are provided in Section 4. The following summarises the main regulations relevant to LWC and provides an overview of gaps with IFC PS2.

The Project is governed by the requirements set out in the Gas Agreement for the Project with the PNG Government, as well as Section 129 Oil & Gas Act 1998 and other national legislation. The labour framework in PNG is primarily governed by the Employment Act 1978, the Industrial Relations Act 1962, and the Industrial Safety, Health and Welfare Act 1961. The Constitution of the Independent State of PNG 1975 gives all citizens the right to choose their employment. The Employment Act 1978 guides employment in the formal sector and regulates matters such as work hours, minimum age of work, and gender discrimination in employment and wages. Despite these rights, the Employment Act 1978 prohibits women

from undertaking certain types of work (e.g., work requiring 'heavy labour'), and from working certain hours unless they hold certain positions. Maternity leave and pay entitlements for women vary across the public and private sectors, however, employers can dismiss pregnant women who have been employed in a job for less than 90 days. In the absence of sexual harassment laws, women frequently experience sexual harassment and discrimination at work (USDOS, 2022).

Rest periods, holiday leave, paid sick leave, minimum wages, overtime pay, requirements for mandatory compensation insurance schemes, and OHS requirements are regulated by labour laws (ILO, 2006). However, limited government enforcement capacity, means that violations of regulations relating to wages, overtime, and OHS are frequently observed in a range of industries, including construction (USDOS, 2022). While workers in the formal sector have the right to unionise, bargain collectively and strike, the government has the power to intervene in labour disputes (e.g., preventing union action through arbitration before strikes could take place) (USDOS, 2022). National labour laws do not cover workers in the informal labour sector. The informal sector is estimated to account for about 80% of employment in PNG and includes workers engaged in activities such as subsistence agriculture and informal sales of goods (USDOS 2022).

PNG's legal framework governing child labour differs from international standards in several respects. Under the Employment Act 1978, children aged between 11 and 16 years may participate in work within family undertakings, with parental consent, provided this does not interfere with school attendance. This provision primarily relates to family-based activities (e.g., subsistence agriculture) rather than formal employment relationships. The Act sets the minimum age for hazardous work at 16 years, which is below the international standard of 18 years. The Act also does not provide a detailed definition of hazardous occupations or activities prohibited for children (USDOS 2022).

The ILO reported that in 2021, 19% of the country's labour force fell within the category of child labour, including instances of prostitution and forced labour (ILO 2021). Approximately 15% of children in PNG have their birth registered, with undocumented children at greater risk for exploitation (USDOS 2023).

There are key gaps between IFC PS2 and PNG employment legislation as summarised below.

- **Discrimination in the Workplace:** PNG has limited statutory protections against workplace discrimination, with no comprehensive law covering gender, disability, age, or other protected grounds. Enforcement is weak. IFC PS2 requires clear non-discrimination policies, harassment prevention, and active monitoring—governance elements not fully embedded in PNG law.
- **Protection of Migrant and Contracted Workers:** PNG labour legislation focuses on direct employees and provides minimal protections for migrant or contracted workers. Regulation of recruitment agencies and prevention of exploitation, such as contract substitution or fee charging, is weak. IFC PS2 requires protections and grievance access for all categories of workers, including contractors and migrants.
- **Prevention of Forced and Bonded Labor:** Although PNG prohibits forced labour, laws do not address modern coercive practices such as debt bondage, retention of identity documents, or deceptive recruitment. IFC PS2 requires proactive prevention of all forms of forced labour, including oversight of labour suppliers.
- **Child Labour Controls and Hazardous Work:** PNG allows children from age 11 to perform light work and permits hazardous work at 16, below IFC and ILO standards. Enforcement capacity for child labour controls is limited. IFC PS2 requires strict minimum ages, monitoring systems, and supply-chain due diligence.
- **Occupational Health and Safety Regulations:** PNG's OHS laws are outdated and lack comprehensive requirements for risk assessments, worker participation, continuous

improvement, or formal incident reporting (IR) frameworks. IFC PS2 requires a modern OHS management system aligned with GIIP.

- **Worker Accommodation Standards** National legislation contains requirements relating to worker accommodation, but enforcement capacity is limited. IFC PS2 requires employers to ensure adequate living conditions following international guidelines, creating a regulatory gap where compliance is often voluntary.
- **Grievance Mechanisms and Worker Engagement:** PNG law does not require employers to establish formal workplace grievance mechanisms with non-retaliation protections. PNG law focuses on traditional employer–employee relationships; limited coverage of contractors and supply chain, whereas PS2 explicitly covers direct, contracted, and supply-chain workers. PNG: 44–48-hour week; 14 days leave; limited sick leave; six weeks unpaid maternity leave. IFC PS2 mandates accessible grievance systems for direct and contracted workers requires clear written terms, adequate rest, and alignment with GIIP—typically requiring more generous maternity/parental leave.
- **Supply-Chain Labour Oversight:** PNG has no legal requirement for companies to conduct labour due diligence in their supply chains. IFC PS2 requires oversight of high-risk primary suppliers, including measures to address child and forced labour risks.
- **Free association:** PNG allows unions, but enforcement is weak. IFC PS2 demands non-interference and alternative mechanisms where law restricts unions.
- PNG Constitution prohibits **discrimination**; employment laws are limited. PS2 requires comprehensive non-discrimination, equal opportunity, and anti-harassment systems.
- **Retrenchment:** PNG has basic notice provisions, IFC PS2 requires structured, consultative Retrenchment Plans.
- **Supply Chain Management:** PNG imposes no general duty on employers for labour conditions in supply chains. IFC PS2 mandates supply-chain due diligence for high-risk sectors.

Overview of Existing Labour and Working Conditions in PNG

PNG's population grew from 8 million to 10 million between 2014 and 2021, with the working-age share rising from 58% to 61.6%, yet formal employment declined from 465,000 to 385,693 over the same period after peaking in 2013 during the PNG LNG Project boom. Although employment has been recovering since COVID-19, by late 2023 it remained 6% below 2013 levels. Labour force participation stands at 52.03%, below the national historical average (59.9%) and global average (60.93%). While unemployment is low (2.74%), most people work in informal or subsistence sectors, with men comprising 52% of the employed population. In the PAoI and Gulf Province, livelihoods are largely subsistence-based, with limited formal employment (around 17% of males and 8% of females), mainly in government, church agencies, logging, the Papua LNG Project, and some foreign-owned fishing businesses, while education outcomes are weak—particularly for females—with high dropout rates and only a small number progressing to tertiary study.

PNG lacks comprehensive national statistics on work-related injuries by industry due to limited reporting systems, especially in informal sectors. Available data is mostly sector-specific from mining, palm oil, and isolated studies, highlighting gaps in formal tracking. However, available data is relatively old. For example, the most recent occupational injury rates for the mining industry were from 2017 (as seen in the Independent State of Papua New Guinea Mining Industry Quarterly). Government tracking of OHS and law is not effective, and enforcement resources are insufficient (according to United States Department of State 2024 Country Reports on Human Rights Practices: Papua New Guinea).

Studies indicate road traffic accidents (43%), assaults (25%), and falls (10%) dominate injury-attributed deaths (13% of total mortalities 2018-2020), often linked to socioeconomic factors rather than industry-specific data. Data from the mining sector reflects the high risks associated with extractive industries. No recent national aggregates exist; 2026 reforms aim to improve data collection (Workplace Responses to Family and Sexual Violence in PNG, IFC 2023)

Reporting, enforcement and compliance are inconsistent and weak outside urban and mining areas with a range of factors that are concerned with labour and working conditions including management of OHS, freedom of association and collective bargaining, forced and compulsory labour. Informal workers lack contracts, social security, and OHS protections, with common issues including hazardous conditions in small-scale mining/agriculture, limited unionisation, and child labour risks in rural areas. The ILO reports that the level of compliance with labour rights in PNG is 1.1 (scored from 0 to 10 (PhamBN, Maraga S, Kue L, et al 2022)). In summary, PNG's LWC governance framework is basic and weakly enforced in areas such as maternity, discrimination, child labour, and grievance systems and OHS management.

Project Workforce Summary

The Project workforce is described within the Project Description (Section 3). Community consultation identified the Project as a main source of income for some PRL-15 villages, with other key sources of income for communities in the PAoI including sale of produce, such as surplus garden food at local markets, and fish maw, fish and shellfish (e.g., crabs) to foreign-owned fish processing businesses, or at local markets. Some communities also noted that they currently sell produce to the Project or previously sold produce to InterOil.

Accommodation

A range of accommodation camps are required during construction and operation to support the Project workforce. These will be located onshore within PRL-15 and offshore on river boats as part of the dredging and material transfer activities during construction. Workforce is also expected to be accommodated at Caution Bay to support HDD works. Plans for accommodation are described in Section 3.1.

6.2.3 Impact Assessment

Potential impacts as documented in the Labour and Working Conditions Management Procedure, 2025, hereafter LWCMP (2025), can be described as follows:

- Poor management of labour (employer-related impacts)
 - o Unfair or discriminatory contracts
 - o Poor working conditions (working hours, rest periods etc)
 - o Occupational safety management
 - o Restrictions in free association
 - o Poor welfare and accommodation standards
 - o Exploitative working practices may occur for example child labour or forced labour particularly in supply chain contractors and suppliers
- Conflicts
 - o Disputes over working time and pay
 - o Conflict between local and expat workers or workers from outside the Gulf Province
 - o Discrimination based on race, religion, gender or sexuality

- o Failure to understand or meet workplace conduct and cultural standards
- o Employment expectations being misrepresented and not met
- Compromised fitness to work and communicable disease due to ineffective health screening and health care
- Sexual harassment and sexual violence
- Inadequate accommodation
- Serious injury or fatality due to poor health and safety management.
- Towards the end of the construction period and into commissioning and operations there will be a decrease in workforce numbers leading retrenchment of workforce numbers.

Some worker grievances are predicted to occur during the project; persistent and repeated grievances and labour and workplace impacts can lead to escalation to industrial action or more serious dispute and broader industrial conflict if not managed according to Project LWC management processes.

As many construction phase activities require workers with specialised technical skills, the LWCMP (2025) also notes that PNG nationals and community-owned businesses in the PAoI risk not being awarded direct employment or contracts due to their lack of technical skills and previous business experience in the petroleum (or other) industries.

6.2.4 Mitigation

The Project is designed to comply with IFC PSs, ILO core conventions, PNG national labour laws, and Company policies on human rights and working conditions.

The LWCMP (2025) outlines how the Project manages LWC across all EPC work packages, contractors, subcontractors, and associated facilities, with the objective of achieving zero harm to people. It aligns with the Company's Code of Conduct, HSE Charter, and other relevant requirements, and is supported by a suite of complementary Project management plans and procedures that together establish the Project's labour management framework. These include:

- Project Recruitment Policy and Procedure
- Project Workforce Complaints and Grievance Procedure
- Project Workforce Disciplinary Procedure
- Project Workforce Demobilisation Procedure
- Project Camps Standards and Working Conditions Procedure
- Project Industrial Relations Monitoring Policy and Procedure
- Project Industrial Action Management Procedure
- Gender Management Plan
- Health Plan
- Project Health Management Procedure.

The labour management framework is further supported by relevant cross-cutting management plans and procedures, including those relating to stakeholder engagement, community health, safety and security, traffic and transport, and emergency response, where labour and workforce issues interface with other E&S disciplines.

Labour risks are managed through the HSE management system (One-MAESTRO framework), covering leadership, risk assessment, competency, communication, and continual improvement.

Company specifications that will also be relevant to the management of LWC include:

- Fundamental Principles of Purchasing (TotalEnergies 2022)

- General Specification: Safety Rules for Buildings (GS EP SAF 221)
- General Specification: Temporary construction camps and associated facilities (onshore) (GS EP CIV 403)
- General Specification: Hygiene on onshore bases and offshore living quarters (GS EP MED 062)
- General Specification: Lighting (GS EP ELE 081)
- General Specification: Preliminary assessment of environmental and health risks related to chronic emissions on operated sites (GS EP ENV 055)
- General Specification: Environmental specification for onshore pipeline construction (GS EP ENV 011)
- General Specification: Social Baseline Study (GS EP SDV 101).

In addition to the above, the Company is committed to the eight fundamental conventions of the ILO. It is also noted that through the Fundamental Principles of Purchasing, the Company requires any suppliers and subcontractors to comply with applicable laws, as well as principles equivalent to those set forth in the Universal Declaration of Human Rights, and the fundamental conventions of the ILO and the UNGPs.

The Project will require Contractors to ensure their activities and actions for workforce and industrial relations and camp management are compliant with the International Standards and PNG Labour Laws. The Project will provide Contractors a basis and template to develop their own (implementation) plans outlining not only mitigation measures but to also incorporate the resources to execute the roles and responsibilities for managing LWC, industrial relations and camp management for the Project.

The Project has developed a National Content Plan and Project Recruitment Policy and Procedure to direct contractors and sub-contractors to maximise work opportunities for citizens of PNG. As per the Project LWCMP Recruitment Procedure this includes in order of priority, PNG citizens from:

- Within the PAoI
- Communities in the wider Gulf Province outside of the PAoI
- Elsewhere in PNG.

In addition, the Project would generate indirect employment opportunities through contractors and third-party suppliers, including for people in the PAoI, Gulf Province, and PNG.

A range of additional mitigation measures which will be applied to manage impacts associated with LWC are described in Table 6-3.

Table 6-3: Mitigation measures – Labour and working conditions

Impact	Mitigation code (As in MP)	Description	Source document
Child and Forced Labour	SM003	Establish a set of local employment and procurement policies that: • Ban employment applications 'at the gate'. • Includes measures to protect the workforce, in particular to identify and avoid child labour and forced labour. • Gives priority to Project Affected Persons (PAPs) and members of PACs (and in particular women) for local employment opportunities. • Maximises the employment and training of national citizens including persons from PACs. • Includes measures for gender-fair hiring and workplace policies.	<i>EIS/Upstream CESMP; 2019</i>
Discriminatory Work Practices	ED037	Continue the employment and where possible the recruitment of women in community relations positions (community liaison officer, village liaison officer, etc.) to conduct specific engagements with women and ensure that women's views and interests are identified.	<i>EIS/Upstream CESMP; 2019</i>
Grievances	ED033	The Project will maintain a grievance mechanism that is legitimate, accessible, predictable, equitable, right-compatible, and transparent.	<i>EIS/Upstream CESMP; 2019</i>
	SM019	Enhance compliance with business ethics: • The Project and its contractors will require that all direct and contracted workers undertake anti-bribery, corruption, ethics and compliance training • The Project will establish an employee whistleblowing system, thereby providing a confidential mechanism to report, e.g., any cases of bribery and corruption, or labour rights infringements in the workforce.	<i>EIS/Upstream CESMP; 2019</i>
Employees and Contractors	SM030	Demobilise all Project workers to their point of hire after their shift/employment is completed.	<i>EIS/Upstream CESMP; 2019</i>
	SM017	Provide healthy and culturally appropriate food choices at workforce accommodation.	<i>EIS/Upstream CESMP; 2019</i>
	SM006	The Project will maximise the procurement of goods and services from local companies including community owned companies. • Major contractors will be required to demonstrate measures and staff organisation they will implement to maximise national content.	<i>EIS/Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		The Project will support eligible small-scale enterprises through capacity building programs and advisory/mentoring services aiming, e.g., to improve business plans, to strengthen management capabilities and to facilitate access to information on project employment and business opportunities. At a local level, business development officers will be appointed to identify and assist eligible small and very small-scale businesses in the Project area.	
	ED036	Transparency and ethics: - The Project Operator makes payments of taxes and royalties in an accurate and timely manner during construction and operations phases. - The Project Operator reports within the PNG Extractive Industry Transparency Initiative (EITI) framework, the amounts of taxes and royalties paid, within its operated perimeter.	<i>EIS/Upstream CESMP; 2019</i>
Project Workforce Health and Sanitation	SM013	Partner with relevant organisations to develop a Health and Wellness Awareness Program for the Project workforce and PACs, particularly in high-risk, in-migration areas. Topics may include preventing and managing communicable and noncommunicable diseases, women's health, nutrition, hygiene and sanitation, and transport safety.	<i>EIS/Upstream CESMP; 2019</i>
	SM015	Develop a tuberculosis (TB) prevention and control program for the Project workforce, including measures to screen and confirm the medical status of TB prior to employment or assignment in the Project area. Project workers diagnosed with active TB will be demobilised to their point of hire, they will be advised to seek treatment and the government will be notified to follow-up with their immediate family members as part of the national TB program. After treatment, a medical evaluation and fitness to work certificate will be required to resume work.	<i>EIS/Upstream CESMP; 2019</i>
	ED034	Continue pre-employment and ongoing health and fitness to work screening and annual medical checks for all workers working for the Project in the Project area.	<i>EIS/Upstream CESMP; 2019</i>
	ED035	Design Project infrastructure (including workforce accommodation) to minimise vector harbourage (e.g., minimise pooling water, proper waste disposal) and human exposure (e.g., screening of doors and windows) to minimise spread of disease.	<i>EIS/Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
	SM012	In areas at high risk of Project-induced in-migration in the PAol, undertake a feasibility assessment in consultation with relevant stakeholders on initiatives to improve health services and infrastructure, and to strengthen health outcomes.	<i>EIS/Upstream CESMP; 2019</i>
	SM014	In areas of high risk of Project-induced In-migration in the PAol, undertake a feasibility assessment in consultation with relevant stakeholders on initiatives aimed at improving water, waste, sanitation and hygiene services (WASH).	<i>EIS/Upstream CESMP; 2019</i>
	SM022	In areas at high risk of Project-induced in-migration in the PAol, undertake a feasibility assessment in consultation with relevant stakeholders on initiatives to encourage regulation and monitoring of in-migration.	<i>EIS/Upstream CESMP; 2019</i>
National Content Capacity Building	SM004	Institutional capacity building: Provide support to capacity building programs aiming to enhance national and local government capacity to foster diversified economic growth and their capacity to deliver local public services.	<i>EIS/Upstream CESMP; 2019</i>
	SM005	Community owned company capacity building: Provide support to governance and capacity building programs to improve business development and planning.	<i>EIS/Upstream CESMP; 2019</i>
	SM006	See above	<i>EIS/Upstream CESMP; 2019</i>
	SM007	Develop initiatives to enhance education and training of youths from the PAol, e.g.: - A scholarship program to provide opportunities for eligible students from the PACs to pursue their studies. - Internships and/or training opportunities with the Project or its contractors specifically focusing on transferable, nationally recognised trade skill development.	<i>EIS/Upstream CESMP; 2019</i>
	SM008	Undertake a feasibility assessment in consultation with local stakeholders on delivering capacity and resilience building programs for Project-affected communities and clan/village leaders, e.g., on financial literacy training and conflict resolution training.	<i>EIS/Upstream CESMP; 2019</i>
	SM009	Investigate options to work with local partners to support the development of sustainable ward development plans in the PRL-15 area and along the export pipeline route	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
	SM010	Partner with development organisations to deliver an education and awareness program (or include such awareness in other community development programs) to enhance the understanding of women's rights, e.g., their right to work, their right to education, more equitable labour activities, and to tackle gender-based violence.	<i>EIS/ Upstream CESMP; 2019</i>
	SM011	In areas at high risk of Project-induced in-migration in the PAoI, undertake a feasibility assessment in consultation with relevant stakeholders on initiatives to improve education infrastructure and capability, and to strengthen education outcomes. While having a focus on elementary and primary schools in the PAoI, secondary and vocational schools in the province might also be considered.	<i>EIS/ Upstream CESMP; 2019</i>

6.2.5 Residual Impacts

The requirements of the LWCMP align with national and international LWC standards. The Industrial Relations Monitoring Policy and Procedure establishes requirements for worker grievance management, dispute resolution processes, monitoring and reporting of labour relations indicators, and contractor compliance with Project labour standards. These mechanisms provide structured processes for identifying, addressing and resolving workforce grievances and potential industrial relations issues during project implementation.

The HRIA assesses potential labour rights impacts in more detail. Table 6-4 below provides a summary of residual impacts pertaining to economic development, employment, significance for education and workforce training.

Table 6-4: Summary of potential residual impacts - Significance for economic development, employment, significance for education and workforce. (Source: Impacts-Social (2019))

Receptor	Main Activity	Potential Impact	Direct / indirect	Location of Activity	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
National business community, supply chain workers	Project employment and procurement	Increased business activity and direct employment opportunities	Direct and indirect	Entire Project footprint	C, O, D	SM003 SM005 SM006 SM007 ED033 ED036 ED037 SM019	Medium / Positive	Positive
Project workforce (both skilled and unskilled). PAPs, PACs, and local communities				PRL-15 Export pipeline route River transport corridor			High / Positive	Positive
Project workforce (both skilled and unskilled), national business community, supply chain workers. PAPs, PACs, and local communities		Decrease in business activity and direct employment opportunities	Direct and indirect	PRL-15 Export pipeline route River transport corridor	O, D	SM004 SM005 SM007 SM009 SM030	Medium / Low	Minor
PAPs, PACs, and local communities				River transport corridor			Medium / Negligible	Negligible
PAPs, PACs, and local communities		Reduction in community cohesion	Indirect	PRL-15 Export pipeline route River transport corridor	C, O, D	SM009	Medium / Low	Minor

Receptor	Main Activity	Potential Impact	Direct / indirect	Location of Activity	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
PAPs		Improved housing and living conditions	Indirect	PRL-15 Export pipeline route	C, O	SM017 SM015 ED034 ED035 SM012 SM014	Medium / Positive	Positive
PAPs, PACs, and local communities including schools		Increased pressure on education services and facilities	Induced	PRL-15 Export pipeline route River transport corridor Baimuru and Ihu LLG. Kikori District	C, O, D	SM007 SM010 SM011 SM008	Medium / Low	Minor
Project workforce (both skilled and unskilled), national business community, supply chain workers. PAPs, PACs, and local communities		Increased workforce skills, training and experience.	Direct	PRL-15 Export pipeline route River transport corridor	C, O, D	SM003 SM008 SM007 SM022	Medium / Positive	Positive

C = Construction, O = Operations, D = Decommissioning and closure.

6.3 Greenhouse Gas

6.3.1 Introduction

This section presents a synthesis of Project documentation relating to GHG. A GHG assessment in conjunction with a climate change study was undertaken for the Project in 2019. The Project will monitor GHG sources and associated emissions, apply Company-approved methodologies to identify emission sources, and consider GHG minimisation and energy efficiency in the selection of development schemes and equipment.

The Project's GHG emissions will not directly affect the local or regional environment but will contribute to PNG's national and global emissions. These emissions may influence PNG's ability to meet commitments made in its National Climate Compatible Development Management Policy and international commitments under the Paris Agreement. Accordingly, the GHG assessment focuses on estimating emissions over the Project life cycle, construction, operation, and decommissioning, and evaluating their significance relative to PNG's national GHG inventory.

The CCRA Synthesis Report (2025) has been developed by the Project. This document reflects the evolution of the Project design, and therefore the GHG emissions projected in the CCRA Synthesis Report (2025) supersede those outlined in the EIS Vol. 3 Part 5 GHG & Climate Change Impact Assessment (2019), hereafter referred to as EIS GHG & Climate Change Assessment (2019), prepared by SLR Consulting Australia Pty Ltd (SLR Consulting).

The Project has also developed an Air Emissions and Greenhouse Gas Management Procedure (2023), dated 20 October 2023 and hereafter referred to as Air GHG Mgmt Proc. (2023), which applies to the construction phase.

The Project's GHG emissions inventory were separated into the following categories:

- Scope 1: emissions produced from sources within the boundary of the organisation that are directly attributed to the organisation's activities.
- Scope 2: emissions from the generation of purchased electricity consumed in owned or controlled equipment of operations.
- Scope 3: emissions generated in the wider economy due to the organisation's activities but are physically produced by the activities of another organisation.

While the assessment of Scope 3 emissions is considered good practice, it is not a requirement under EP4 Guidance Note. In line with this, Scope 3 emissions are not discussed further within this ESHIA Synthesis.

It is also noted that impact magnitude was not determined within the documents reviewed, instead GHG assessments were utilised to aid the assessment of climate impacts as reflected in the EIS (2019) and CCRA Synthesis Report (2025).

6.3.2 Baseline

PNG's national GHG emissions profile and climate policy framework are defined primarily through its Nationally Determined Contribution (NDC) under the Paris Agreement. PNG submitted its first NDC in 2016 and an enhanced NDC in 2020, which builds on the original submission and sets out both mitigation and adaptation priorities.

PNG's enhanced NDC recognises the country's reliance on oil and gas production as a key driver of economic development, while simultaneously committing to long-term decarbonisation objectives. The Government

has articulated a national target to achieve 50% carbon neutrality by 2030 and full carbon neutrality by 2050. The NDC explicitly accommodates continued development of the energy sector within this framework.

National emissions data reported in PNG's most recent Biennial Update Report (CCDA 2022) indicate that total GHG emissions increased between 2000 and 2015, followed by declines in 2016 and 2017. The energy industries sector and the Land Use, Land Use Change and Forestry (LULUCF) sector are identified as the two sectors with the greatest influence on PNG's emissions profile.

For the energy industries sector, PNG has set a headline policy objective of carbon neutrality, supported by non-GHG quantitative and action-based targets. For the LULUCF sector, the enhanced NDC includes a 2030 target to reduce annual net emissions from deforestation and forest degradation associated with agricultural expansion and commercial logging by 10,000 Gg CO₂-e relative to 2015 levels. However, whilst the Project will place upwards pressure on PNG's GHG emissions trajectory, PNG's Enhanced NDC includes provision for this. As such, the Project is not inconsistent with PNG's Enhanced NDC or long-term strategies under the Paris Agreement (CCRA Synthesis Report, 2025).

Determining Project Boundary

The Project boundary for Scope 1 emissions includes the footprint of wellpads, CPF, Logistics Base, Herd Base, Purari Airstrip, onshore and offshore pipelines, and the Caution Bay landfall. Emissions from construction, operation, and decommissioning of these areas are included in the calculation of Scope 1 emissions, as well as emissions from transportation of materials and personnel from Port Moresby to the Project site, including dredging, barge and air transport and movement within the Project area. Decommissioning emissions are indicative due to uncertainty over the final plant outcome.

Scope 2 emissions are considered negligible, as the Project will generate its own power and does not rely on significant external electricity.

Calculation of the GHG emissions from the Project was undertaken in a five-stage process:

- Definition of the Project boundary (geographical and operational).
- Identification of emission sources within the Project boundary.
- Identification of emission calculation methods for each source.
- Identification of activity data for each emission source.
- Calculation of GHG emissions.

The Project's GHG inventory was developed using established emission factors, applied through a hierarchy prioritising Intergovernmental Panel on Climate Change (IPCC) guidelines (IPCC 2006), Australian National Greenhouse Accounts Factors Workbook (DEE 2018), and published industry guidelines for GHG emission inventory development such as Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC 2003).

Alternative Scenarios

The CCRA was undertaken using a baseline period and two future assessment horizons to capture both near- and longer-term climate-related risks and opportunities relevant to the Project lifecycle.

For physical climate risks, climate trends were assessed for:

- A baseline period (1980–2010)
- A near-term period centred on 2030 (2015–2045)
- A longer-term period centred on 2050 (2035–2065).

Climate projections were derived from global datasets and assessed across three climate change scenarios developed by the Intergovernmental Panel on Climate Change (IPCC): SSP1-2.6, SSP2-4.5, and SSP3-7.0. These scenarios span a range of plausible future greenhouse gas concentration pathways and associated climate outcomes, allowing for a robust evaluation of potential physical climate hazards.

For transition risks and opportunities, the assessment compared future conditions in 2030 and 2050 against a baseline year of 2023. Transition risks were evaluated across Policy and Legal, Technology, and Market and Reputation risk categories, using three scenarios from the International Energy Agency's World Energy Outlook 2023: Stated Policies Scenario (STEPS), Announced Pledges Scenario (APS), and Net Zero Emissions by 2050 Scenario.

The selected scenarios are not intended to predict future outcomes or endorse any particular pathway. Rather, they are used to stress test the Project against a range of plausible future climate and transition conditions, recognizing that regulatory, market, and technological developments are dynamic, uncertain, and geographically variable.

Estimated Scope 1 emissions may vary under each future energy scenario in line with projected changes in global LNG trade, assuming emissions respond linearly to production. Emissions associated with the construction phase are broadly aligned across all scenarios until 2030. Beyond this, stricter regulations and increased adoption of low-carbon technologies under the Announced Pledge Scenarios (APS) and Net-zero Emissions (NZE) scenarios are expected to reduce LNG demand, leading to lower production and greater emissions reductions, particularly after 2045. The Stated Policies (STEPS) scenario aligns with the Project baseline, reflecting a gradual emissions decline as natural gas continues to act as a transitional fuel. Overall, the Project's Scope 1 emissions are expected to remain broadly consistent across scenarios and track the planned decline in gas production from 2046, with alignment to APS or NZE after 2044 dependent on economic viability and availability of enhanced mitigation measures, (CCRA Synthesis Report, 2025).

6.3.3 Impact Assessment

GHG emissions impact magnitude is defined by the scale, duration, reversibility, and contribution to national and global emissions, rather than localised biophysical change. Impacts are assessed in relation to PNG's national GHG inventory and international climate obligations (e.g. Paris Agreement) (EIS GHG & Climate Change Assessment, 2019).

- Magnitude reflects the quantity of emissions (kt CO₂-e), duration (temporary vs life-of-Project), and contribution to cumulative emissions.
- Likelihood reflects certainty that emissions will occur, based on project design and operational assumptions.
- Significance combines magnitude and likelihood, noting that GHG impacts are global, cumulative, and long-term, and cannot be mitigated entirely at a local scale.

Table 6-5: Impact magnitude definitions for GHG

Impact Magnitude	Definition
Very High	Large, long-term emissions (>1,000 kt CO ₂ -e per annum), sustained over multiple years; major contribution to national GHG inventory; difficult to avoid or offset.
High	Substantial emissions (500 – 1,000 kt CO ₂ -e per annum), multiple-year duration; material contribution to national emissions.
Medium	Moderate emissions (100-50 kt CO ₂ -e per annum); temporary or declining over time; partial mitigable.

Impact Magnitude	Definition
Low	Minor emissions (<100 kt CO ₂ -e per annum); short duration; readily mitigated or managed.
Negligible	Very small emissions; short-term; no meaningful contribution to cumulative emissions.

Construction

The main contributor to the estimated Scope 1 emissions for the construction phase is the loss of carbon stocks due to land clearing. Calculation of deforestation emissions are based on the pre-FEED footprint total clearance of 1,005ha. The loss of naturally sequestered carbon from clearing land has been included in the GHG emissions estimates for the construction phase only as there will only be minimal land clearing during the operational phase related to the pipelines (CCRA Synthesis Report, 2025).

Clearing will take place during construction for pipelines, roads, wellpads, camps, logistics bases, an airstrip, waste facilities, and disposal areas within the Project's Upstream Component, with pipelines representing the largest single source of land disturbance. Cleared pipeline corridors will be allowed to partially regrow, though vegetation will be maintained and large-rooted trees restricted, resulting in relatively stable carbon stocks over the Project life. As a result, the total loss of natural carbon sequestration from construction-related land clearing is estimated to contribute less than 2% of the Project's lifetime Scope 1 emissions (CCRA Synthesis Report, 2025).

While the emissions calculations presented in the EIS (2019) have been superseded by the updated CCRA Synthesis Report (2025) to reflect refined design and methodology, it is assumed that the construction emissions inventory sources (i.e., Project activities) remain materially unchanged and are therefore still representative for the purposes of this assessment as seen in the table below.

Table 6-6: GHG Emission sources associated with the Project Included in the (2019) Emissions Inventory (Construction) EIS GHG & Climate Change Assessment (2019)

Construction	
Project Activity	Scope 1 Emissions
Vegetation clearing	Initial loss of carbon stock; decomposition of cleared vegetation; ongoing loss of sequestration
Site establishment & earthworks	Diesel combustion in earthworks machinery
Construction (CPF, onshore pipelines, camp, logistics base, etc.)	Diesel combustion in construction equipment (drill rigs, forklifts, cranes, concrete batch plants, etc.)
Offshore export pipeline construction	Diesel combustion in pipe-laying, supply, accommodation, crew, and survey vessels
Transport of workers	Diesel combustion in light vehicles, buses, ferries; Avgas combustion in aircraft
Power generation	Diesel combustion in portable generators (gensets)
Barging	Diesel combustion in barges transporting materials and supplies
Solid waste & wastewater management	Emissions from organic waste decomposition and incineration

Operation

The primary source of Scope 1 GHG emissions during the operational phase stems from generating the necessary power to sustain the associated operations. Minor sources include the necessary safety flaring, non-routine flaring, venting, and mobile vehicles and vessels involved in operations. The profile reflects start-up flaring and variations in power and heat requirements, resulting in varying GHG emission intensity. (CCRA Synthesis Report, 2025).

The Project's annual Upstream Scope 1 emissions are expected to increase over the life of the Project. It is noteworthy that this projection incorporates the benefit of acid gas reinjection, which is projected to permanently store approximately 18,000 ktCO₂ from 2030- 2049 (CCRA Synthesis Report, 2025).

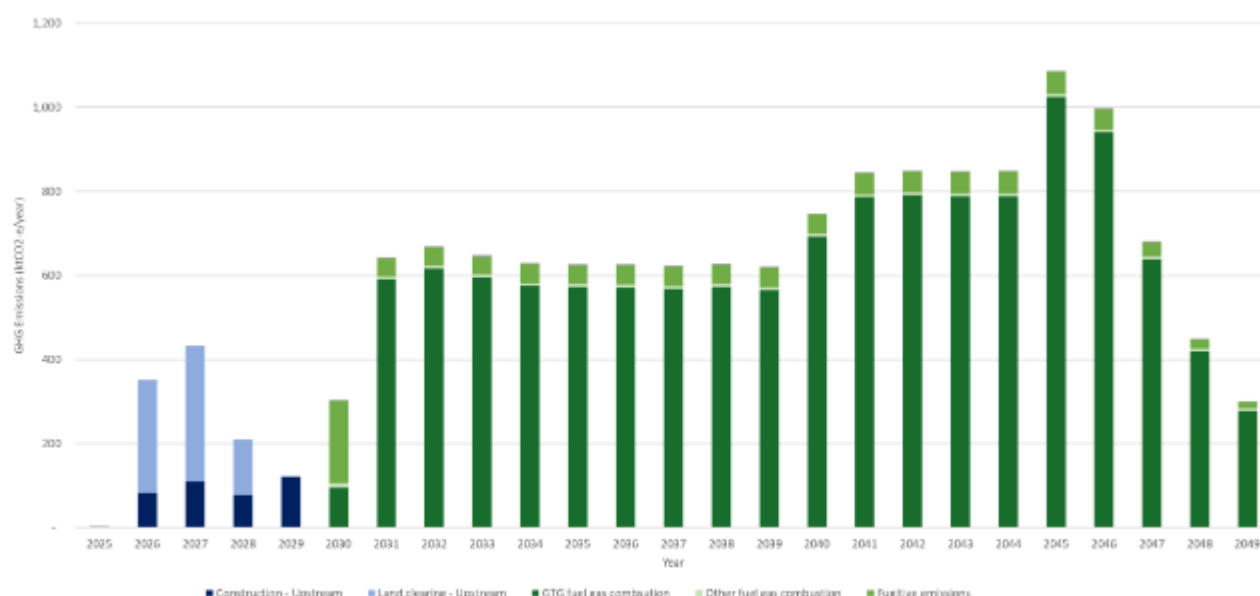
Injection of native acid gas (H₂S and CO₂) will begin as soon as production commences. Around 2040, the Antelope Reservoir pressure could decline, and additional energy may be required to extract the natural gas at the same rate. This increased energy demand could lead to an increase in GHG emissions. Notably, the low-pressure phase will likely coincide with the Project's decrease in LNG production, which will ultimately lead the Upstream Component emissions to start decreasing (CCRA Synthesis Report, 2025).

As with construction, while the operational emissions calculations presented in the EIS (2019) have been superseded by the updated CCRA Synthesis Report (2025) to reflect refinements in design and assessment methodology, it is assumed that the most operational emissions inventory sources remain materially unchanged and continue to be representative for the purposes of this assessment as seen in Table 6-7.

Table 6-7: GHG emission sources associated with the Project Included in the (2019) Emissions Inventory (Operations) EIS GHG & Climate Change Assessment (2019)

Operations	
Project Activity	Scope 1 Emissions
Fuel gas combustion	Fuel gas combustion in compressors, boilers, and power generation units
Venting	CO ₂ emissions from venting of acid gas
Flaring	Emissions from gas flaring at CPF and wellpads
Transport of workers	Diesel combustion in vehicles and ferries; Avgas combustion in aircraft
Barging	Fuel combustion in barges delivering equipment and supplies
Solid waste & wastewater management	Emissions from organic waste decomposition and incineration

Figure 6-2 shows the estimated annual project Scope 1 GHG emissions from construction to decommissioning against the estimated annual LNG production figures. Emissions will peak in 2045 and then reduce as production declines, and the project enters decommissioning.



Note: In 2030, construction and production emissions have been combined as this is the final year of construction and first year of production.

Figure 6-2: Estimated Annual Scope 1 GHG Emissions Profile – Upstream Component, CCRA Synthesis Report (2025)

Decommissioning / Closure

End of Life emissions are expected to reduce proportionally with LNG production which is expected to decline from 2045 to 2049 according to the CCRA Synthesis Report (2025).

The Papua LNG Project is anticipated to enter the decommissioning phase in 2050, with zero GHG emissions projected beyond 2051. Depending on the balance between emissions reductions elsewhere in PNG's economy, and carbon sequestration from nature-based solutions, during the late 2040s the Project could constitute a substantial portion of PNG's residual GHG emissions. Decommissioning emissions are relatively minor, estimated at 25 kt CO₂-e per year over two years (about 0.2% of total life-of-Project Scope 1 emissions), EIS GHG & Climate Change Assessment (2019).

Table 6-8: GHG Emission Sources Associated with the Project Included in the (2019) Emissions Inventory (Decommissioning) EIS GHG & Climate Change Assessment (2019)

Decommissioning	
Project Activity	Scope 1
Earthworks & rehabilitation	Diesel combustion in trucks, machinery, cranes, forklifts
Transport of workers	Diesel combustion in vehicles and ferries; Avgas combustion in aircraft
Barging	Diesel combustion in barges transporting equipment and demolition materials
Solid waste & wastewater management	Emissions from organic waste decomposition and incineration

6.3.4 Mitigation

The EIS (2019) outlines key GHG emission reduction measures that align with EP4 and Task Force on Climate-related Financial Disclosures (TCFD) guidelines, aimed at mitigating long-term financial and reputational risks:

- **No Routine Flaring:** Flaring of natural gas is strictly limited to essential safety requirements (start-up, maintenance, emergencies, and flare pilots).
- **Native Gas Reinjection:** Reinjection of native acid gas (H₂S and CO₂) will begin as soon as production commences.
- **Natural Gas-Powered Electricity:** The Project will primarily generate its electricity from natural gas, significantly minimising diesel use.

From 2030 onwards, under the APS and NZE scenarios, the anticipated introduction of carbon pricing and stricter emissions regulations will increase global pressure on such projects to implement these technologies from the outset.

TEP PNG Policies and Guidelines

TEP PNG's GHG mitigation and assessment requirements include minimising emissions, optimizing energy efficiency, and eliminating continuous flaring and venting wherever feasible.

Key requirements include:

- **Flaring and venting minimisation:** No continuous flaring or venting of associated gas during normal operations unless no feasible alternative exists; reinjection is the preferred approach; safety flaring and temporary flaring during start-up or operational upsets should be minimised through technical planning, redundancy, and maintenance strategies.
- **Energy optimisation:** Minimise fuel gas consumption and optimise energy use over the facility lifecycle; installation of waste-heat recovery units where justified; online monitoring of energy efficiency for major equipment.
- **Monitoring and measurement:** Accurate flare header metering, minimised vented volumes, and characterisation of fuel gas composition to ensure efficient operation.

The Project design incorporates these requirements to align with TEP PNG's corporate GHG mitigation and management objectives.

The Air Emissions and Greenhouse Gas Management Plan (2023) provides a framework for managing GHG emissions across all phases of the Project.

Table 6-9 below describes the mitigation measures to address Scope 1 & 2 GHG emissions.

Table 6-9: Mitigation measures – Greenhouse gases

Impact	Mitigation code (As in MP)	Description	Source document
Greenhouse Gases	EM051	Assess total Project GHG emissions and potential impacts at the completion of front-end engineering design (FEED) and include relevant mitigations in the Construction Environmental and Social Management Plan (CESMP).	<i>EIS Addendum; 2024</i>
	EM044	Implement standard practices to minimise fuel consumption, e.g., reduce speeds and idling times, maintain good road conditions, reduce site gradients, optimise vehicle tire pressure and maintain vehicles	<i>EIS/ Upstream CESMP; 2019</i>
	ED002	The Project will design its plant to meet the applicable emission standards and relevant ambient air quality criteria beyond the proposed facility boundary.	<i>EIS/ Upstream CESMP; 2019</i>
	ED023	The flares will be used only for safety flaring in alignment with the Total Energies no routine flaring policy	<i>EIS/ Upstream CESMP; 2019</i>
	ED027	The Project will generate its own electricity during the operations phase, which will minimise the use of diesel and related emissions.	<i>EIS/ Upstream CESMP; 2019</i>
	ED028	Waste-heat recovery units will be installed on the power gas turbines	<i>EIS/ Upstream CESMP; 2019</i>
Operation of vehicles, machinery, fixed and mobile plant and equipment, transport and power generation	EM045	Implement fugitive emissions measurement controls	<i>EIS/ Upstream CESMP; 2019</i>
	ED001	Vessels will comply with applicable International Maritime Organization requirements related to fuel to minimise related atmospheric emissions (IMO 2021).	<i>EIS/ Upstream CESMP; 2019</i>
	ED019	All vehicles (including vessels and aircraft) and machinery, plant and equipment will be regularly maintained to the manufacturer's specifications; defective items will be removed from service until they are repaired.	<i>EIS/ Upstream CESMP; 2019</i>
	EM043	Waste incineration shall:	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
Waste generation, storage and disposal; and waste incineration.		• Use appropriately designed incinerators commensurate with proposed inventory. • Be considered for waste that will effectively combust. • Be operated within the required specification and by competent personnel.	
	ED005	The landfill will be designed to comply with TotalEnergies' general specification for landfills, and will be designed, located, constructed and operated in general accordance with the intent of the Code of Practice for Sanitary Landfill Sites (DEC, 2001) and other applicable standard industry practices.	<i>EIS/ Upstream CESMP; 2019</i>
Vegetation clearance and earthworks; logistics and use of Project roads; spoil disposal, construction (i.e., wellpad, trunkline/flowline construction)	EM029	• Actively or passively rehabilitating bare sites as soon as possible to promote a stable self-sustaining landscape. • Allow forest edges to naturally regenerate or create appropriate conditions to facilitate natural regeneration, e.g. rip the substrate, replace topsoil, apply mulch. • Rehabilitate Pandanus habitats, e.g. recreate mounds, re-instate the intertidal surface between Pandanus mounds. • Rip compact surfaces across the slope, as appropriate, to facilitate revegetation and minimise erosion. • Spread stockpiled topsoil, organic matter and cleared vegetation over the rehabilitation area to promote natural regeneration. • Use native vegetation to revegetate sites when active rehabilitation measures are required.	<i>EIS/ Upstream CESMP; 2019</i>
Project Infrastructure	ED029	Buildings will be insulated, where practicable.	<i>EIS/ Upstream CESMP; 2019</i>

6.3.5 Residual Impacts

An RIA for GHG emissions was completed in the EIS Vol. 1 Ch. 15 Impacts Amenity & Climate Change (2019), hereafter referred to as EIS Impacts Amenity & Climate Change (2019). While this assessment remains a valid record of GHG analysis undertaken at that time, it was prepared prior to subsequent Project design changes. As a result, the GHG emission estimates and comparative analysis presented in 2019 are no longer fully representative of the current Project configuration. The CCRA Synthesis Report (2025) does discuss residual impacts in a dedicated section however, the report notes that as the Project (upstream and downstream, inclusive of new and existing trains) will produce an estimated 34 MtCO₂-e in scope 1 GHG emissions over its lifetime, and it is estimated that emissions may ramp-up to maintain production level later in the project until the late 2040s. Depending on the balance between emissions reductions elsewhere in PNG's economy, and carbon sequestration from nature-based solutions, during the late 2040s the Project could constitute a substantial portion of PNG's residual GHG emissions. Additionally, whilst the Project will place upward pressure on PNG's GHG emissions trajectory, the Enhanced NDC includes provision for this. As such, the project is considered to be partially NCC aligned as it neither clearly undermines nor contributes to meeting the NCCs. This finding of partial alignment indicates that the Project is not inconsistent with PNG's Enhanced NDC.

6.4 Air Quality

6.4.1 Introduction

This section presents a synthesis of project documentation relating to air quality. Characterisation of the existing environment within PRL-15 was conducted in the Upstream Environmental and Social Baseline Studies (2017), hereafter referred to as ESBS (2017), and assessment of E&S impacts of the Upstream Project was undertaken in the EIS (2019).

With reference to document EIS Vol. 2 Part 19 Upstream Air Quality Baseline (2017), hereafter referred to as EIS Air Quality Baseline (2017), the objectives of the air quality baseline study were defined as follows:

- Define the study area for the air quality baseline characterisation that would also support an impact assessment.
- Characterise the meteorological patterns in the study area with the potential to impact on the generation and dispersion of air emissions from the Project.
- Characterise the existing ambient air quality to enable an estimation of background concentrations of relevant air pollutants (i.e. those anticipated to be emitted by the Project) to allow an assessment of potential cumulative impacts.
- Identify existing potentially sensitive receptors within the study area, such as local villages and ecosystems.
- Identify / summarise the key values of the air quality environment in the study area.

The objectives follow the requirements of the CEPA (formally DEC) Guideline for submission of an application for an environmental permit to discharge waste (DEC, 2004a). Further to this guideline, Technical Guideline (Additional Information) Air discharges (DEC, 2004b) sets out the information that should be provided as part of an application for an Environment (Waste Discharge) Permit where air emissions may be generated. These requirements include:

- Details of the source, nature, composition and rate of air emissions.
- Information on emissions control equipment and proposed methods to minimise air discharges.
- Maintenance procedures and contingency procedures to avoid air discharges from process failure and shut down.
- Stack emission details.
- Calculated ground level concentrations of pollutants proposed to be discharged to air under normal and maximum operating conditions as well as under start up and shutdown conditions.
- An assessment of the impact of the proposed Project on the environment.

The EIS Addendum (2024) updates air quality impact assessment undertaken in the EIS (2019) for the new CPF location (P3), and the revised acid gas management strategy. The EIS Addendum (2024) air quality impact assessment draws on the additional study titled Papua LNG CPF Relocation – Air Quality Impact Assessment (2024).

6.4.2 Baseline

The Air Quality Baseline Study (2019) was prepared focusing on existing sensitive receptors and identified a number of human settlements close to the P2C CPF site. The Air Quality Baseline Study (2019) noted that villages are not common along much of the PER until close to the coastline.

Following relocation of the CPF to the P3 site, the EIS Addendum (2024) revises the list of sensitive human receptors in relation to the CPF, identifying Pokore Hamlet as the closest sensitive receptor (0.7 km southeast of the CPF P3 boundary). Other sensitive human receptors, and their distance from the CPF P3 boundary, include Poroi 1 (3.8 km south, southwest), Purari Airstrip (5.8 km southwest), Ne'ea Creek (formerly Mapaio Fish Camp, 9.9 km west), and Herd Base (0.8 km east). Regarding Hou Creek, there are no local industrial sources and emissions are dominated by small-scale river traffic and village activities. Potential receptors include nearby villages (e.g. Ura and Purari River settlements (closest located at ~4km) and transient river users, with large separation distances between the Hou Creek base/extraction areas and static receptors.

Ambient Air Quality

The EIS Air Quality Baseline (2017) describes the study area as undeveloped and there are no major existing sources of combustion products (i.e., NO_x, SO_x, CO and PAHs), H₂S or glycols located within the airshed. As a result, ambient concentrations of these pollutants can reasonably be expected to be negligible under normal conditions. While there is the potential for elevated concentrations of combustion-related pollutants to occur during agricultural burn-offs and in the event of forest fires, such events are intermittent, highly variable and relatively short term. Given that ambient concentrations will be negligible compared to relevant international guidelines for ambient air quality except for these intermittent abnormal events, baseline monitoring of these pollutants is not warranted (EIS Air Quality Baseline (2017)).

Broadly, the ambient air quality baseline conditions are described to include ‘some natural (e.g. pollens) and anthropogenic (e.g. cooking fires, generators (if used) and agricultural activities)’ sources of particulate matter, background levels of particulate matter are also expected to be low, given the high rainfall, low wind speeds and dense vegetation in the area. Low total suspended particulate levels are attributed to environmental factors such as high rainfall, low wind speeds, and dense vegetation which naturally suppress dust’ (EIS Air Quality Baseline (2017)).

Table 6-10, sourced from EIS Air Quality Baseline (2017) summarises the expected baseline particulates concentrations.

Table 6-10: Expected baseline particulates concentration (Source: EIS Air Quality Baseline (2017))

Pollutant	Averaging Period	Range of Background Particulate Concentrations Expected to Occur in the Study Area (µg/m³)	Background Concentration Assumed (µg/m³)
Total Suspended Particulates (TSP)	24-hours	10 – 70	50
	Annual	20 – 40	40
PM ₁₀	24-hours	5 – 35	25
	Annual	10 – 15	15
PM _{2.5}	24-hours	2 – 20	15
	Annual	5 - 8	8

The current closest existing source of air emissions to the proposed CPF site is Herd Base, where diesel-powered generators are currently used to provide power.

Meteorological Modelling

An air quality model was developed to determine the anticipated dispersion and concentration of atmospheric pollutants resulting from the operation of the CPF, for which input meteorological data were obtained. In the absence of data local to the Project site, meteorological data were obtained from the meteorological station in Wabo located 38km north-northwest of the proposed CPF site. Details of the data recorded at the station are as follows:

- Latitude: 7.00666, longitude: 145.073°.
- Elevation: 433 m above mean sea level.
- Parameters: wind speed and direction, temperature, rainfall, relative humidity, barometric pressure.

All available data from this station were obtained which covered the period:

- 1st June 2013 – 19th December 2015.

The topographical conditions at the Wabo meteorological station differ from those at the CPF site, creating the potential for the accuracy used in the model at Wabo to vary in relation to conditions at the CPF. To account for this potential limitation, the EIS Air Quality Baseline (2017) applied 3-dimensional meteorological data to recreate and predict topographical influences at the CPF. Similar methodologies had been used elsewhere in PNG and been demonstrated to represent actual conditions with a high degree of reliability.

To supplement approximately 19-months of recorded meteorological data, meteorological modelling was performed by BMT ARGOSS for the study area using the Weather Research and Forecasting (WRF) model (BMT ARGOSS, 2014, 2015a and 2015b). The model configuration used in the WRF model was initially validated for a 1-year model run for 2012 based on observational data from Jackson International Airport at Port Moresby and Horn Island, prior to performing a 10-year model run (2004-2013) for the wider Project area including PRL-15. A review of the validation (BMT ARGOSS, 2014) showed that the model configuration used by BMT AGROSS resulted in statistically acceptable predictions of temperature and atmospheric pressure at both Port Moresby (320km distant from the Project site) and Horn Island (located in the Torres Strait, some 600km distant from the Project site). Predicted wind speeds at Horn Island were also in agreement with observational data, however WRF over-predicted wind speeds at Port Moresby. No wind roses or wind direction data were presented to demonstrate whether WRF had accurately characterised the predominant wind directions.

For the EIS Addendum (2024), carried out subsequent to the relocation of the CPF to the CPF P3 site, the model data inputs were updated with regional meteorological records for 2022, the most recent calendar year available. The modelled meteorological data were not and have not been validated using local data.

Baseline Data

The following summarises the air quality baseline data for the Project:

- Baseline ambient air quality data has been inferred as location-specific data are not available for the Project.
- Modelled meteorological data were generated for plume dispersion models for the operation of the CPF.
- Gas composition for the Elk and Antelope fields (see Table 6-11 below).

Table 6-11: Summary of Antelope and Elk gas compositions (Source: EIS Vol. 1 Ch. 04 Project Description, 2019)

Compound	Concentration	Reservoir	
		Antelope	Elk
Methane	%	86.7	90
Ethane	%	3.6	2.6
Propane	%	1.2	0.6
Other C1-C35 hydrocarbons	%	<1	<1
CO ₂	%	5.7	5.2
Nitrogen	%	0.4	0.4

Compound	Concentration	Reservoir	
		Antelope	Elk
Hydrogen sulfide	ppm	140 to 200	5
Benzene	ppm	340	340
Toluene	ppm	340	340
Ethylbenzene	ppm	40	40
Xylene	ppm	880	880
Mercury (in elemental state)	µg/Nm ³	1	1
Arsenic compounds*	µg/Nm ³	To be confirmed	To be confirmed

*Arsenic compound concentrations are being verified with further analysis

Emissions Modelling

Air quality modelling was carried out for Project operations, considering three Project gas turbines (which will provide the Project's power requirement), three boilers, and two flare options. The modelling considered three scenarios:

1. Normal Operations;
2. Flaring – Acid Gas Flare Off-line
3. Flaring – Acid Gas Flare On-line.

Under Scenario 1 (Normal Operations) it was assumed there would be 3 operating gas turbines. Under this scenario of normal operations, the modelling results showed that predicted ground level NO₂, SO₂, and CO concentrations are anticipated to be well below the relevant ambient air quality guidelines adopted for use in this study (WHO 2021 USEPA 2024, European Commission 2008) at all identified sensitive receptor locations, and across the entire modelling domain beyond the site boundary.

Air dispersion modelling for both flaring scenarios (Scenario 2 – Acid Gas Flare Off-Line and Scenario 3 – Acid Gas Flare On-Line) indicates that maximum predicted ground-level concentrations of NO₂, SO₂ and CO are well below the relevant ambient air quality guidelines adopted for the assessment at all identified sensitive receptor locations and across the entire modelling domain beyond the site boundary. Considering the assumed negligible background concentrations for gaseous pollutants, the results demonstrate that emissions associated with either flaring scenario are not expected to result in exceedances of applicable air quality criteria or cause adverse impacts at surrounding receptors.

For both flaring scenarios, the maximum predicted incremental 24-hour and annual average particulate matter concentrations (PM₁₀ and PM_{2.5}) at all identified sensitive receptors are negligible when compared with the adopted WHO guideline values and assumed background levels. As such, the modelling indicates that emissions from the Project are unlikely to make any notable contribution to ambient particulate matter concentrations or result in measurable impacts at surrounding sensitive receptor locations.

It is also noted that the maximum ground-level VOC concentrations predicted for the CPF in the EIS (2019) were negligible compared to the relevant ambient air quality criteria and were not reassessed in the EIS Addendum (2024).

6.4.3 Impact Assessment

The updated Air Quality Impact Assessment undertaken as part of the EIS Addendum (2024), identified the following potential adverse off-site air quality impacts (i.e. decline in human health, amenity or vegetation condition) to sensitive receptors in relation to the new CPF location (P3):

- Human health impacts, due to emissions of:
 - o Finer inhalable particulate matter (i.e., PM₁₀ and PM_{2.5}) associated with fuel combustion processes are small enough to penetrate the thoracic region of the respiratory system. The health effects of inhalable particulate matter include the aggravation of asthma and other respiratory symptoms, and an increased incidence of cardiovascular and respiratory diseases and lung cancer.
 - o Emissions of NO_x, CO, and SO₂ from the combustion of fuel gas and diesel, which can adversely impact human health by irritating the airways of the lungs, aggravating asthma and other existing respiratory illnesses, and increasing the incidence of acute respiratory illness in children.
 - o Chronic long-term exposure to elevated concentrations of VOC emissions of VOCs, as can adversely impact human health, increasing the risk of developing conditions such as cancer, central nervous system disorders, liver and kidney damage, reproductive disorders and birth defects.
- Amenity impacts, specifically:
 - o Nuisance impacts due to the larger-sized particles of fugitive dust settling rapidly close to the source and soiling of surfaces in and around residential areas.
 - o Many VOCs are also highly odorous and can also adversely impact on amenity values due to odour nuisance.
- Vegetation impacts, due to:
 - o Larger-sized particles of fugitive dust settling onto leaves, blocking sunlight and disrupting photosynthesis, thereby damaging nearby vegetation.

For Hou Creek, potential impacts identified in the Hou Creek Aggregate Dredging EAR (2025) include fugitive dust from aggregate extraction, haulage and processing at Hou Creek base. As well as combustion emissions from dredging barges, tugs, supply vessels, passenger ferry, excavators, trucks and generators. Potential impacts on human health and amenity from these sources are qualitatively assessed and then largely discounted from detailed analysis because: i) the closest village (Ura) is ~4 km from extraction and ~8.5 km from the processing area, and other villages are further away; ii) only up to two barge trips and two ferry trips per week are proposed; and iii) the local river and valley setting provides rapid dispersion, and river users are exposed only briefly when passing operations.

For borrow pits and access roads, potential impacts identified in the FEED Changes EAR (2025) associated with construction of borrow pits and access roads include the generation of fugitive dust emissions from clearing, earthworks, vehicle movements and material handling. One key impact pathway identified for borrow pits and access roads is the deposition of larger dust particles on nearby vegetation, potentially blocking sunlight on leaves and disrupting photosynthesis. A Medium pre-mitigation risk of air quality impacts to vegetation along access roads is given. Human health impacts from borrow pit combustion emissions and dust were not reassessed in the FEED Changes EAR (2025) because of the 1.5 km or greater separation distance to receptors, in line with the EIS (2019) findings.

The main conclusions as determined by the updated air quality impact assessment from the EIS Addendum (2024) for the proposed CPF at the P3 Site are presented below.

Construction Phase

Based on the Institute of Air Quality Management (IAQM 2014) construction dust risk assessment methodology, there is a Negligible or Low risk of human health or dust nuisance impacts associated with the earthworks and construction activities proposed at the CPF-P3 site, even if no dust mitigation measures were to be implemented. This is due to the low population density in the surrounding area and heavy rainfall.

The risks of any potential ecological impacts are concluded to be Medium during earthworks and Low during construction, if no dust mitigation measures were to be implemented. As these impacts will be localised and short-term in duration, any affected vegetation can be expected to recover rapidly, particularly given the high rainfall in the region.

Fugitive dust emissions from construction of the infield production facilities and infrastructure are also identified as potentially being generated by the Project.

Operation Phase

As identified in the EIS Air Quality Baseline (2017), air pollutants that have the potential to be generated by the Project include:

- Combustion-related NO_x, SO_x, CO and particulates
- H₂S
- VOCs and methane
- Glycols
- PAHs.

The results of the air dispersion modelling study for the latest available emissions data and plant layout for the CPF-P3 site show that for:

- All three operational scenarios assessed, the maximum ground-level NO₂, SO₂, CO and particulate matter concentrations predicted at the sensitive receptors and at all off-site locations are well below the relevant ambient air quality criteria.
- Annual average off-site SO₂ concentrations beyond the site boundary would range up to a maximum of 7.3 µg/m³, which is below the International Cooperative Programme (ICP) United Nations Economic Commission for Europe (UNECE) 2017 guideline of 20 µg/m³ for adverse impacts on vegetation and forest ecosystems. The modelling study notes that no adverse impacts on vegetation would therefore be anticipated due to SO₂ emissions from the CPF.

6.4.4 Mitigation

FEED Changes EAR specifies implementation of the Project Air Emissions and Greenhouse Gas Management Procedure for construction dust and combustion emissions at borrow pits and along access tracks. IAQM construction dust guidance is adopted, with controls implicitly including:

- Watering and dampening of exposed surfaces and haul roads.
- Good practice traffic management (speed control, minimising drop heights, covering loads).
- Progressive rehabilitation of disturbed areas.

Air quality impacts on human receptors are discounted because of distance and operating profile, but the Hou Creek Aggregate Dredging EAR (2025) still commits to standard combustion and dust controls via:

- Project Air Emissions and Greenhouse Gas Management Procedure (combustion emissions from dredging barge, tugs, trucks, generators and processing plant).
- Project Traffic and Transport Management Procedure (manages vehicle speeds, routes, and numbers, thereby limiting dust from the Hou Creek access road and base).
- A new site-specific management plan for Hou Creek Aggregate Dredging will consolidate relevant measures, including dust management tied back to project procedures

The engineering design information upon which the AQIA was based incorporated design mitigation measures that will reduce the potential for adverse off-site air quality impacts from CPF operations. These include:

- Discharging air emissions from fuel-burning equipment at the CPF via appropriately designed stacks so that air pollutants are dispersed adequately.
- Installing flares to combust gases discharged during upset operating conditions (and during start-up and maintenance activities) to minimise emission of air pollutants and maximise dispersion of the combustion gases.
- Disposing of acid gas from the acid gas removal unit by injecting it into the ANT reservoir.

In addition to these findings, and consistent with updated air quality criteria to reflect the WHO guidelines (WHO 2021), the following mitigation and management measures will be implemented to further reduce impacts on air quality.

Table 6-12: Mitigation measures - Air quality

Impact	Mitigation code (As in MP)	Description	Source document
Adverse human health, nuisance effects and vegetation effects due to fugitive dust from construction activities, quarry operations, and roads.	EM041	Implement dust control, where required.	<i>EIS/ Upstream CESMP; 2019</i>
	EM029	Actively or passively rehabilitating bare sites as soon as possible to promote a stable self-sustaining landscape. e.g.: - Allow forest edges to naturally regenerate or create appropriate conditions to facilitate natural regeneration, e.g. rip the substrate, replace topsoil, apply mulch. - Rehabilitate Pandanus habitats, e.g. recreate mounds, re-instate the intertidal surface between Pandanus mounds. - Rip compact surfaces across the slope, as appropriate, to facilitate revegetation and minimise erosion. - Spread stockpiled topsoil, organic matter and cleared vegetation over the rehabilitation area to promote natural regeneration. - Use native vegetation to revegetate sites when active rehabilitation measures are required.	<i>EIS/ Upstream CESMP; 2019</i>
Adverse human health and nuisance effects due to fuel combustion emissions from operation of vehicles, machinery, fixed and mobile plant and equipment, and marine, river and air transport.	ED019	All vehicles (including vessels and aircraft) and machinery, plant and equipment will be regularly maintained to the manufacturer's specifications; defective items will be removed from service until they are repaired.	<i>EIS/ Upstream CESMP; 2019</i>
	EM042	Use low sulphur fuel, as far as practicable.	<i>EIS/ Upstream CESMP; 2019</i>
	ED002	The Project will design its plant to meet the applicable emission standards and relevant ambient air quality criteria beyond the proposed facility boundary.	<i>EIS/ Upstream CESMP; 2019</i>
	ED001	Vessels will have to comply with applicable IMO requirements related to fuel to minimise related atmospheric emissions'.	<i>EIS/ Upstream CESMP; 2019</i>
	ED030	Fixed or mobile equipment will be used and/or located in consideration of people and other sensitive receptors.	<i>EIS/ Upstream CESMP; 2019</i>
	EM045	Implement fugitive emissions measurement controls.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
Adverse human health effects from combustion emissions of air pollutants associated with waste incineration	EM043	Waste incineration shall: • Use appropriately designed incinerators commensurate with proposed inventory. • Be considered for waste that will effectively combust. • Be operated within the required specification and by competent personnel.	<i>EIS/ Upstream CESMP; 2019</i>

6.4.5 Residual Impacts

Air quality in the EIS Addendum (2024) is assessed through atmospheric dispersion modelling of emissions from the CPF (P3) and comparison of predicted ground-level concentrations with recognised international ambient air quality criteria. As PNG does not have statutory ambient air quality standards, the assessment adopts the WHO air quality guidelines, supplemented by relevant US EPA and IFC guidance. Modelled concentrations of key pollutants at identified sensitive receptors are compared with these criteria, with results indicating that predicted levels are well below the applicable guideline values.

For borrow pits and access roads: residual air quality impacts are limited to Minor significance, due to highly localised dust deposition on vegetation immediately adjacent to access tracks, with no measurable change in ambient air quality or health risk at nearby villages due to distance and effective dust controls.

For the Hou Creek aggregate dredging area: residual air quality impacts (from both dust and combustion emissions) are assessed as Negligible for surrounding communities and transient river users, with any dust-related effects on nearby terrestrial habitats embedded within broader habitat degradation impacts that are rated Minor to Negligible in significance. Based on the identified potential impacts and the suite of mitigation measures already embedded into the Project's engineering design and management plans, residual impacts at the CPF are expected to be low.

Project activities have the potential to generate emissions of particulate matter, combustion-related pollutants (NO_x, SO₂, CO), VOCs, fugitive dust, and other operational air pollutants that may affect human health, amenity, and vegetation. To minimise these effects, the Project incorporates extensive design-level controls, including appropriate stack heights for effective dispersion, use of flaring systems to combust gases during non-routine events, and acid-gas injection to substantially reduce SO₂ emissions. Additional operational mitigation includes dust suppression, limiting land disturbance, maintaining vehicles and combustion equipment, using low-sulphur fuels where practicable, and implementing controls for waste-incineration emissions.

Air dispersion modelling indicates that, with these embedded measures in place, predicted pollutant concentrations at all identified sensitive receptors remain well below international ambient air quality criteria across all operational scenarios. Continuous emissions monitoring and an ambient air-quality monitoring programme will be ensured to track emissions levels and respond if they exceed internationally accepted air-quality criteria.

6.4.6 Unplanned and Non-Routine Events: Air Quality

Section 6.4.6 synthesises Project documentation relating specifically to unplanned and non-routine events that could impact air quality.

Construction Phase

There are no major unplanned events that could give rise to non-routine or unplanned emissions to air, except for a major fire event. Major fires giving rise to combustion products (smoke and vapours) may occur due to accidental ignition of construction facilities, laydown areas, bulk fuel storage areas etc.

Operations Phase

The potential sources of unplanned emissions to air during commissioning and operation are as follows:

- Short term-controlled releases using the pressure relief systems resulting in flaring may be actuated during commissioning.
- Process upsets causing emergency flaring may occur during commissioning resulting in potential exceedances of air quality regulatory levels.

- Loss of well control, blow-out and H₂S release (covered in Major Hazards and Infrastructure and Process Safety).
- Major fire releasing combustion products (smoke and fumes to the atmosphere).
- Pipeline breaches.

The risk of fire, explosion and gas releases during operations is considered in the Major Hazards and Infrastructure and Process Safety section (see Section 6.1).

In general, non-routine emissions will be of small magnitude and duration in comparison with operational emissions and will be subject to natural dispersion.

The risk to human life (workforce and local communities) is described in the Onshore Pipeline Quantitative Risk Analysis Report (2025), hereafter referred to as Onshore Pipeline QRA (2025). The overall risk for the onshore pipelines is low. The 'Broadly Acceptable' risk threshold for onsite personnel and the public does not impact any known residential areas along the onshore pipelines route. The societal risk for the known local settlements and villages in proximity to the pipeline route falls into the 'Broadly Acceptable' and ALARP region. There is low risk to known villages or local settlements in Orokolo Bay, there is however a potential for future development/growth in these areas which could lead to increased risk levels.

Decommissioning / Closure Phase

During decommissioning emissions may be generated during cleaning of pipework and process units and tanks spaces prior to dismantling. Such emissions will be small magnitude and duration.

Mitigations for Unplanned and Non-routine Events

Commissioning and decommissioning will be subject to detailed planning and risk assessment (Ready for Startup processes) to minimise the risk of non-routine emissions. Where there is a risk of venting or intermittent flaring, communities will be informed in advance via the CLO. Where emergency venting or flaring takes place, retrospective communications with local communities will be made.

During operations the risk to surrounding communities in the Orokolo Bay region will be monitored to ensure risk criteria thresholds are not exceeded.

Residual Impacts for Unplanned and Non-routine Events

The residual impacts of unplanned and non-routine emissions during construction and operations have not been assessed but are likely to be of small magnitude and short duration and are therefore assessed as being minor.

6.5 Local Climate and Climate Change

6.5.1 Introduction

This section synthesises climate change considerations relevant to the Project, including local climatic conditions and broader climate change context.

GHG emissions are assessed in a separate GHG section (Section 6.3), which focuses on the quantification and evaluation of Project-related GHG emissions and the Project's contribution to national and global emissions, reflecting the global and cumulative nature of GHG impacts. Potential impacts of climate change on the Project, including physical climate risks, resilience and adaptation measures, are addressed separately in a standalone CCRA Synthesis Report (2025). Together, these assessments address the requirements of Equator Principle 2, ensuring that both the Project's contribution to climate change and climate-related risks to the Project are appropriately evaluated in accordance with international good practice.

A climate change study was conducted to assess the Project's vulnerability to projected climate effects in the region, identifying potential direct and indirect impacts and opportunities to enhance resilience.

The assessments focus on the Project's operational phase over its 25-year design life, considering direct impacts such as damage to Project assets and indirect impacts including disruptions to suppliers and critical logistics hubs. Additional risks include regulatory changes or shifts in global energy demand due to climate policies, which may affect natural gas markets.

6.5.2 Baseline

The historical and existing climate features of PNG have been compiled based on information contained within reports published by the Australian Bureau of Meteorology (BoM) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO), as part of the Pacific Climate Change Science Program (PCCSP). The PCCSP is a collaborative research partnership between Australian Government agencies, East Timor and 14 Pacific Island countries including PNG.

The reports reviewed included:

- Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports (BoM, CSIRO, 2014)
- Climate Change in the Pacific: Scientific Assessment and New Research, Volume 1: Regional Overview (BoM, CSIRO, 2011a)
- Climate Change in the Pacific: Scientific Assessment and New Research, Volume 2: Country Reports (BoM, CSIRO, 2011b).

Physical Climate Change Baseline

The methodology for the Physical CCRA was developed in alignment with the Equator Principles Guidance Note (2023) and the TCFD recommendations. A systematic approach was applied to identify and analyse risks associated with climate-related hazards.

Climate data for the baseline, near-term (2030), and long-term (2050) periods were compiled from multiple global datasets and normalised to enable comparison across the three IPCC scenarios. Initial trend analysis indicated that projected increases in extreme heat and extreme rainfall are more pronounced than for other climate hazards. Normalised climate indicators were subsequently integrated into the risk analysis framework, which involved the sequential application of vulnerability ratings, raw risk ratings, and material risk ratings.

Given the diversity of infrastructure and operational characteristics across the Project, the Physical CCRA was undertaken separately for:

1. Upstream and Midstream components
2. Downstream components.

This approach ensured that variations in exposure, sensitivity, and adaptive capacity were appropriately captured and that risks relevant to different Project operators were clearly identified. This ESHIA Synthesis focuses on Upstream and Midstream Components only.

Transition Climate Change Baseline

The Transition CCRA was conducted in accordance with the Equator Principles Guidance Note (2023) and the TCFD Guidance on Scenario Analysis. Risks and opportunities were assessed for the years 2030 and 2050 relative to the 2023 baseline, selected to align with the Project's anticipated operational timeframe extending to approximately 2049.

The assessment examined potential impacts arising from changes in climate-related policy and regulation, technological development, and market and reputational dynamics under the selected International Energy Agency (IEA) scenarios. This approach supports an understanding of how different transition pathways could affect the Project's long-term resilience and financial performance.

Regional Climate Baseline – PNG

PNG is located near the equator within the oceanic tropics and experiences a hot and humid tropical climate characterised by two distinct seasons: a wet summer season and a drier winter season. Average temperatures typically range from approximately 26°C to 28°C throughout the year.

PNG has one of the most humid and wet climates globally, with relative humidity commonly between 70% and 90% and annual rainfall exceeding 2,500 mm in many regions. Under the Köppen–Geiger Climate Classification, PNG is classified as tropical rainforest climate.

Regional climate conditions are strongly influenced by:

- The trade wind systems
- The South Pacific Convergence Zone (SPCZ), a major rainfall belt that migrates seasonally across the Pacific
- El Niño–Southern Oscillation (ENSO) dynamics
- Monsoonal circulation patterns.

Existing Climate Features

PNG experiences substantial climate variability due to natural atmospheric and oceanic cycles. These include the ENSO, the Interdecadal Pacific Oscillation (IPO), and the Pacific Decadal Oscillation (PDO). ENSO, with a 2 to 7-year cycle, drives much of the year-to-year variability, influencing droughts, floods, tropical cyclones, extreme sea levels, and coral bleaching. ENSO has two extreme phases, El Niño and La Niña, with ENSO-neutral conditions occurring when neither phase is apparent.

Temperature trends in PNG show weak seasonal variation, but a clear long-term warming trend in both annual and seasonal mean temperatures. Minimum temperatures have increased more rapidly than maximum temperatures, and warm extremes have become more frequent while cool extremes have decreased, consistent with global warming.

Rainfall patterns vary markedly across the country. Southern PNG has a wet season from November to April and a dry season from May to October, while northern regions receive more consistent rainfall year-round.

In the Purari catchment, lower regions experience higher rainfall during the southeast trade wind season (May–October), reversing the pattern observed in upper regions. Year-to-year rainfall variability is high, with wettest years receiving up to three times the rainfall of driest years, largely driven by ENSO. Long-term trends in rainfall, consecutive dry days, and rain days show little change and are not statistically significant.

Extreme events include tropical cyclones, primarily affecting southern PNG between November and April. Port Moresby experiences an average of six cyclones per decade, some severe. La Niña events bring heavy rainfall, floods, and landslides, while El Niño events are associated with droughts.

Sea levels show inter-annual variability of about 23 cm and have risen approximately 7 mm per year since 1993, higher than the global average. Sea-surface temperatures have gradually increased since the 1950s at about 0.11°C per decade, while ocean acidification has reduced the aragonite saturation state (Ω_{arag}) from about 4.5 in the late 18th century to around 3.9 by 2000, negatively affecting coral reef growth.

Wind and wave conditions vary between coasts. The south coast, including Port Moresby, experiences predominantly southeast-directed waves with strong seasonal variation, peaking from June to September. Northern areas, such as Kavieng, experience variable trade wind and monsoon-driven waves, with higher waves in December–March. Wave heights for rare events are estimated at 4.1 m near Port Moresby and 3.0 m near Kavieng. Wave climate shows strong inter-annual variability on the north coast linked to ENSO, while variability on the south coast is less pronounced. Long-term historical trends in wave climate are not well documented.

Climate Vulnerability Context

PNG is ranked by the World Bank as the tenth most climate-vulnerable country globally, reflecting high exposure and sensitivity to climate-related hazards. This vulnerability is driven by projections of increasing frequency and intensity of extreme climate events and the potential for cascading impacts on land, infrastructure, livelihoods, and social stability. These broader socio-economic and environmental vulnerabilities have the potential to influence Project performance and are therefore considered within the CCRA Synthesis Report (2025).

6.5.3 Impact Assessment

The CCRA Synthesis Report (2025) reviewed existing climate conditions and future projections for PNG using PCCSP data and evaluated Project components sensitive to climate change. Potential impacts were assessed based on exposure (duration, frequency, intensity), sensitivity (degree of effect), and the adaptive capacity of the Project. Climate-related risks for the Project were assessed using projected changes for PNG under two emissions scenarios: RCP2.6 (very low emissions) and RCP8.5 (very high emissions).

The climate change study for the Project was conducted using established methodologies for assessing climate risks and adaptation opportunities in the oil and gas sector. The study involved:

- **Literature Review:** Characterizing the existing climate and variability in PNG and the Project area, including rainfall, flood levels, storm frequency, and temperatures, and reviewing anticipated regional climate changes.
- **Vulnerability Assessment:** Identifying Project components sensitive to projected climate changes, considering both direct and indirect climate threats.
- **Risk Characterisation:** Evaluating each potential climate threat based on exposure (duration, frequency, intensity, magnitude, and orientation of events) and sensitivity of Project assets (design, materials, construction quality, maintenance, protective systems).

- **Adaptive Capacity:** Assessing the Project's ability to prepare for, respond to, and recover from climate threats through design choices, backup systems, management, maintenance strategies, and availability of physical resources.
- **Overall Vulnerability:** Determining the Project's potential vulnerability based on its exposure, sensitivity, and adaptive capacity to climate-related threats.

Table 6-13: Impact assessment matrix for climate risk (Source: CCRA Synthesis Report, 2025)

Sensitivity of System to Climate Threat	Exposure of System to Climate Threat				
	Very Low	Low	Medium	High	Very High
Very High	Medium	Medium	High	Very High	Very High
High	Low	Medium	Medium	High	Very High
Medium	Low	Medium	Medium	High	Very High
Low	Low	Low	Medium	Medium	High
Very Low	Very Low	Low	Low	Medium	High

Key findings include:

- **Flooding and landslides:** Increased risk due to higher rainfall and extreme events, potentially damaging infrastructure and disrupting logistics (barging, roads).
- **Ambient temperatures:** Low vulnerability due to high adaptive capacity.
- **Wave conditions:** Nearshore and river mouth waves already constrain vessel operations; future increases due to climate change, though uncertain, could exacerbate risks. Adaptation measures have been identified for implementation where required.
- **Temperature:** Warming is projected, with higher air temperatures increasing power demand, reducing efficiency of compressors, and raising risks of heat stress and mosquito-borne diseases.
- **Rainfall:** Annual and seasonal rainfall is expected to increase moderately, raising the risk of flooding, landslides, erosion, and temporary loss of access to infrastructure. Extreme rainfall events are projected to become more frequent, potentially affecting logistics and construction activities.
- **Sea Level:** Sea levels are projected to rise, potentially inundating pipeline structures and restricting barge access in coastal areas.
- **Cyclones and Droughts:** Cyclone frequency may decrease slightly, but intensity could increase, posing risks to infrastructure. Drought frequency is expected to remain stable, with no significant associated risks identified.
- **Wind Waves:** Wave conditions already restrict vessel operations. Future changes are uncertain, so potential increases in wave height remain a risk.
- **Potential impacts on the Local Community:** Extreme weather and landslides could damage community and non-Project infrastructure, indirectly affecting Project operations. Enhancing community resilience to climate impacts can support Project productivity. The PNG Government's climate and GHG initiatives, along with economic development from the oil and gas sector, are expected to provide resources for climate adaptation projects and improved local infrastructure.

Table 6-14 summarises the CCRA for the Project, identifying key climate-related threats and evaluating the Project's sensitivity, exposure, potential impacts, adaptive capacity, and overall vulnerability. The assessment considers how extreme weather events, flooding, erosion, landslides, and sea-level-related changes could affect Project infrastructure, workforce health and safety, logistics, and supply chains, as well as how these

impacts may indirectly affect local communities and shared infrastructure. While many risks are assessed as low to medium due to the Project's high adaptive capacity and existing design controls, several climate threats, particularly those related to flooding, landslides, and coastal processes, have the potential to disrupt access, logistics, and operations.

Table 6-14: Climate risk impact assessment summary (Source: CCRA Synthesis Report (2025))

Climate Threat	Sensitivity of Project to Climate Threat	Exposure of Project to Climate Threat	Impact	Adaptive Capacity of Project	Vulnerability of Project
Higher power demand and fuel gas consumption (e.g., increased air conditioning demand, compressors operating less efficiently)	Low	Low	Low	Very High	Low
Increased risk of worker illness from diseases	Very Low	Low	Low	High	Low
Increased risk of worker illness from heat stress	Very Low	Low	Low	High	Low
Increased risk of flooding at logistics facilities (Herd Base, Logistics Base and Purari Airstrip) resulting in supply chain disruptions and temporary loss of access	Low	Medium	Medium	Very High	Low
Increased risk of barges and other watercraft colliding with uprooted trees and other debris during or after flooding events	Low	Medium	Medium	High	Medium
Increased risk of erosion and landslides damaging CPF, pipelines, wellpads etc.	Low	Medium	Medium	Medium	Medium
Increased risk of temporary loss of access to Project infrastructure and supply chain disruption caused by damage of access roads due to landslides/flooding	Low	Medium	Medium	Medium	Medium
Increased leachate management requirements for landfills	Very Low	Low	Low	Very High	Low
Delays to construction and decommissioning activities	Very Low	Medium	Low	High	Low
Increased risk of accidents (e.g., driving hazards) during wet weather	Very Low	Medium	Low	Medium	Medium
Inundation of pipeline structures at Orokolo Bay and Caution Bay	Very Low	Low	Low	Very High	Low
Increased risk of damage to Project infrastructure due to more intense cyclones	Medium	Low	Medium	Very High	Low
Restricted barge access at the coast due to changes in seabed associated with sea level rise	High	Low	Medium	High	Medium

Key Findings from the Climate Change Risk Assessment Synthesis Report (2025)

Impact Materiality

From a physical climate risk perspective, the Project aligns with PNG's national climate change (NCC) policies and commitments. The Project is consistent with PNG's priorities for climate adaptation and resilience, and the CCRA Synthesis Report (2025) concludes that project-related physical climate risks have been identified and appropriately addressed.

From a transition risk perspective, the Project is not inconsistent with PNG's Enhanced NDC or long-term strategies under the Paris Agreement despite the Project placing upward pressure on PNG's GHG emissions trajectory. There is, however, partial alignment with global decarbonisation pathways, considering PNG's specific circumstances. This reveals nuanced risks, specifically on the sustained LNG production beyond 2045 and reliance on regulatory protections that could amplify perceptions of misalignment with these pathways particularly if global scrutiny on the oil and gas sector intensifies.

Financial Materiality

Physical climate risks remain relatively consistent through 2050 and contribute more to the Project's risk profile than transition risks. Current high-risk hazards include flooding and rainfall-induced landslides, with extreme heat and rainfall rated medium. By 2050, extreme heat may rise to high, and extreme winds/storms to medium under two different future scenarios: a moderate emissions pathway (SSP2-4.5), representing continued current trends with intermediate climate change, and a high emissions pathway (SSP3-7.0), representing a fragmented world with higher GHG emissions and stronger warming.

Transition risks are expected to increase over time under low- and mid-emissions scenarios (IEA, APS, NZE). Present-day stakeholder concern represents a medium risk, while access to new markets offers a high opportunity. By 2030–2050, risks from shifting customer behaviour and uncertain market signals could rise to high (NZE, APS), and carbon-pricing/reporting obligations may elevate risks to medium. Opportunities may decline but remain medium where supportive policies or new markets persist.

The CCRA Synthesis Report (2025) concludes that many physical risks can be mitigated through engineering and design, while long-term transition risks will require contractual, market and technological strategies. Planned measures such as acid-gas sequestration (via reinjection) and hydrogen-ready combined-cycle power generation support resilience. Overall, risks increase and opportunities diminish over time, with physical risks dominating in higher-carbon futures, and transition risks becoming more important under faster global decarbonisation.

Alternatives Analysis

The Project's alternatives analysis identifies measures to reduce emissions across its lifecycle. Current initiatives include a downstream Combined Cycle Power Plant, upstream CO₂ sequestration (via reinjection), and flare gas recovery. Future options under consideration include CO₂ capture technology, hydrogen-ready turbines, and potential integration of renewables such as solar or wind. Recommended actions include accelerating these technologies, expanding carbon-capture capacity, and undertaking feasibility studies on advanced carbon capture and hydrogen integration. Collectively, these measures enhance long-term sustainability and support alignment with lenders' emissions-reduction objectives

6.5.4 Mitigation

The CCRA Synthesis Report (2025) does provide a range of physical and transition risk mitigation measures across its life cycle that could be applied by the Project. These measures are designed to enhance resilience to extreme weather events, manage operational impacts, and ensure the long-term safety and efficiency of Project infrastructure, operations, and the workforce. These are under consideration by the Project and are presented here.

Physical Climate Mitigation Measures

The Project has integrated physical climate resilience into its design, operations, and infrastructure management. Existing measures include flood monitoring along the Purari River, metocean studies, temperature monitoring, tank insulation, and climate-controlled worker accommodations. Materials used in LNG processing are engineered to withstand extreme high and low temperatures (up to 650°C and down to -161°C), reducing the need for additional mitigation for processing operations.

Mechanisms for Mitigating Market Risks

Market-related risks are influenced by the commercial structure of offtake agreements, including factors such as floor pricing, term length, termination conditions, and creditworthiness of off-takers. Long-term agreements may favour buyers and expose the Project to price fluctuations, but several strategies can help reduce this exposure:

- **Targeted market supply:** Prioritising markets with limited regulatory pressure to decarbonise, where LNG remains a lower-carbon transitional fuel compared to coal.
- **Offtake agreement structure:** Using floor pricing, termination clauses, and careful selection of creditworthy buyers to manage financial risks.
- **Marketing approaches:** Sponsors may adopt portfolio affiliate marketing or third-party Sale and Purchase Agreements (SPAs), each presenting distinct risk profiles.
- **Lender considerations:** Creditworthiness and enforceability of obligations are paramount; investment-grade sponsors with proven LNG marketing track records can materially reduce market exposure.

Additional Mitigation Strategies

- **Road Management**
 - o **Drainage infrastructure:** Installation of ditches, culverts, and stormwater management structures to prevent flooding.
 - o **Erosion control:** Sedimentation ponds, vegetative stabilisation, retaining walls, and slope protection.
 - o **Flood risk assessment:** Continuous evaluation of high-risk areas with prioritisation of mitigation investments.
 - o **Vegetation management:** Regular maintenance to prevent obstruction of drainage systems.
- **Onshore and Offshore Pipelines**
 - o **Route selection:** Inland and coastal routes optimised to reduce flood and erosion exposure.
 - o **Climate-resilient design:** Adequate burial depth, corrosion protection, anchoring, and use of durable materials.
 - o **Monitoring and early warning systems:** Detection of groundwater level changes, soil moisture, and pipeline integrity.
 - o **Geological and slope stability:** Retaining walls, drainage systems, and vegetative cover to reduce landslide hazards.
 - o **Corrosion protection:** Cathodic protection and robust offshore pipeline design to withstand ocean salinity and temperature variations.
- **Operations and Facilities**

- o **Enhanced cooling systems:** Air-cooled condensers, evaporative cooling towers, and chilled water systems to manage extreme heat on critical equipment.
- o **Operational adjustments and automated controls:** Optimised performance of compressors and equipment during peak heat periods.
- o **Thermal insulation and shading:** Insulated buildings, reflective films, awnings, and vegetation to reduce heat gain.
- o **Health and safety protocols:** Emergency plans for extreme heat, including shaded rest areas, misting fans, and activity scheduling during cooler periods.
- **All Project Assets**
 - o **Climate-resilient design:** Use of durable, weather-resistant materials; elevated platforms; and flexible designs to adapt to changing conditions.
 - o **Proactive maintenance:** Regular upkeep of drainage, roofing, foundations, jetties, and landfill infrastructure to prevent flooding, erosion, and contamination.
 - o **Emergency preparedness:** Evacuation plans, temporary shelters, and flood monitoring systems to protect personnel and maintain operations.

6.5.5 Residual Impacts

Due to the nature of how risks and impacts are assessed for subject matter on local climate and climate change, this section does not cover residual impacts. For associated residual impacts see Section 6.3 on GHG emissions.

6.6 Noise and Vibration

6.6.1 Introduction

This section presents a synthesis of the Project documentation relating to the potential impacts of terrestrial and underwater noise and vibration on human and biodiversity receptors during the construction, operations and decommissioning stages of the Project. Noise is generally described as being ‘unwanted’ unfavourable sound, and to some extent this is an individual or subjective response, as what may constitute sound to one person may be noise to another.

In the context of ‘environmental’ noise, the term is typically used to refer to unwanted or potentially harmful sound created by human activities, typically including noise emitted by means of transport, construction and industrial activities.

The following sub-sections consider terrestrial and underwater noise separately.

6.6.2 Terrestrial Noise and Vibration Baseline

The Project conducted a literature review in October 2016 which indicated that minimal information regarding the existing ambient baseline noise environment was available in the upstream Project area and particularly at potential noise sensitive receptor sites in the vicinity of Project components. Nonetheless, based on available information, the background noise environment is likely to be affected by high levels of insect noise and other natural ambient noise sources such as, birds, periods of heavy rainfall, and (for existing village locations) domesticated noise from animals and typical village activities (music, construction, human voices noise). The information gained from the literature review has been used to identify gaps in the baseline information and thus plan the noise field baseline survey. A noise baseline study was completed in as per EIS Vol. 2 Part 20 Upstream Noise Baseline (2017), hereafter referred to as EIS Noise Baseline (2017), using both attended and unattended noise survey techniques. An additional noise baseline study was subsequently conducted in 2025 using unattended noise survey techniques.

The noise monitoring survey was carried out in two stages from 31 October to 20 November of 2025 and presented in the Upstream Baseline Noise Survey (2026), hereafter referred to as Noise Baseline (2026). This report notes that loggers were first deployed to six locations. The loggers were retrieved after a period of one week, then redeployed at each of the second round of six locations, totalling twelve sites. Where monitoring locations were in or near villages, locals were informed of the surveyors’ presence and purpose prior to logger deployment. A CLO was also present at the deployment of the noise monitors to answer any questions posed by the local communities and serve as general liaison.

Figure 6-3: Provides a map of noise monitoring locations used for the Noise Baseline (2026).

MAP OF BASELINE NOISE MONITORING LOCATIONS

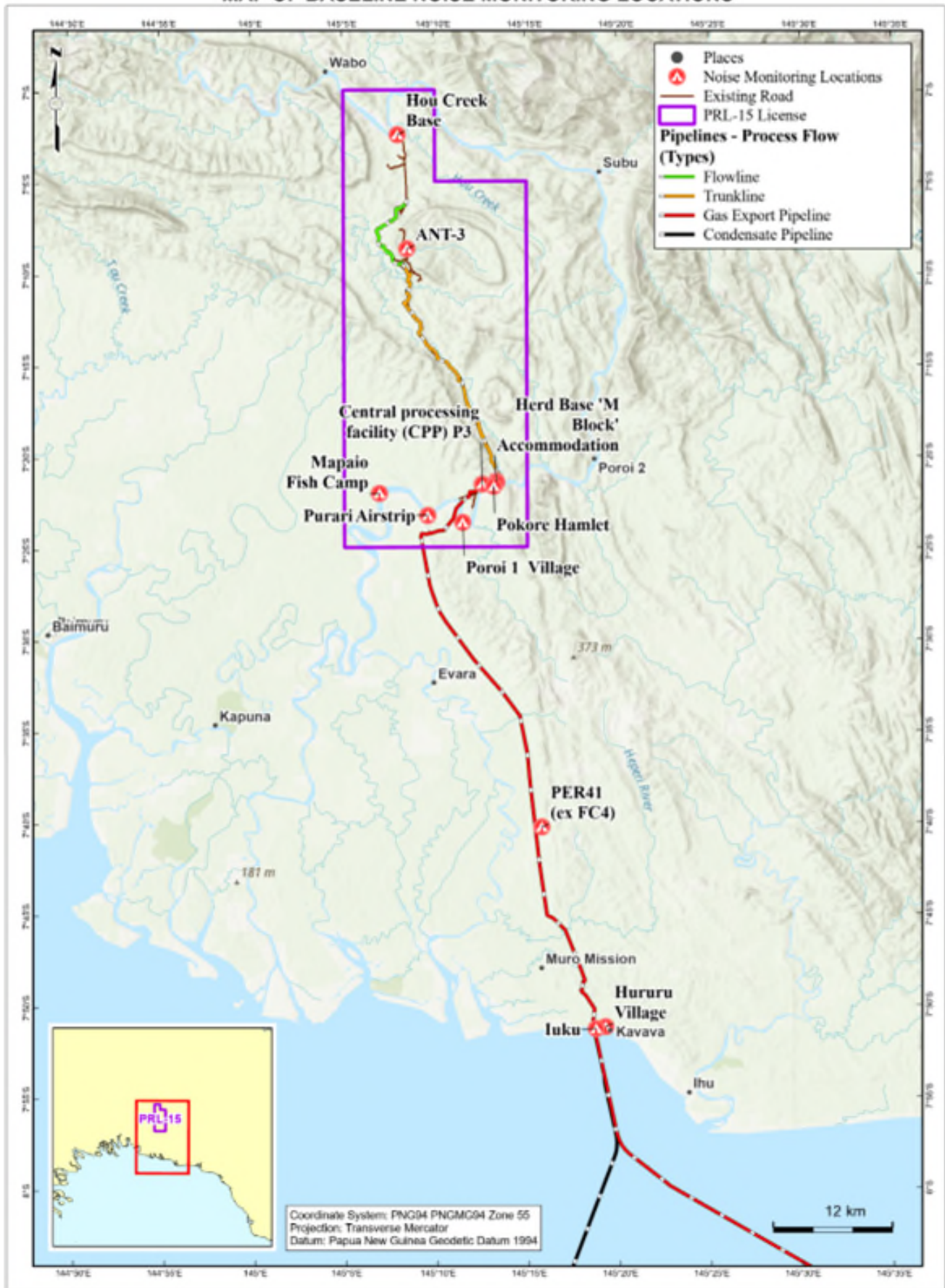


Figure 6-3: Map of noise monitoring locations (Source: Noise Baseline, 2026)

Observations taken during the noise survey and analysis process are presented below in Table 6-15. Most locations were monitored over 8 days, with the exception of Iuku and Hururu which were monitored over 11 days.

Table 6-15: Noise monitoring result averages for night and day. Results to 2 d.p. Bold numbers indicate those calculated averages that are above regulation levels according to time of day and location of logger in relation to nearby receptors. (Source: Noise Baseline (2026)).

Site	Measurements Started	Measurements Stopped	Average Day (7h-22h) L_{Aeq}	Average Day (7h-22h) L_{A90}	Average Night (22h-7h) L_{Aeq}	Average Night (22h-7h) L_{A90}
Herd Base 'M Block' Accommodation	Friday 31 October 2025, 16:15	Friday 07 November 2025, 17:00	58.50	50.63	58.29	50.14
Herd Base Aviation Tower	Friday 31 October 2025, 17:00	Friday 07 November 2025, 17:00	63.63	50.13	56.00	48.29
Purari Airstrip	Saturday 01 November 2025, 09:15	Saturday 08 November 2025, 09:15	56.25	40.63	59.14	57.43
Poroi 1 Village	Saturday 01 November 2025, 10:00	Saturday 08 November 2025, 10:00	57.63	45.00	56.14	51.57
Pokore Hamlet	Saturday 01 November 2025, 11:00	Saturday 08 November 2025, 11:00	59.88	42.63	59.29	53.86
CPF P3	Saturday 01 November 2025, 14:00	Saturday 08 November 2025, 14:00	63.25	57.25	64.71	60.57
Mapaio Fish Camp	Thursday 06 November 2025, 09:30	Thursday 13 November 2025, 09:30	64.88	41.25	64.71	55.00
Hou Creek Base	Sunday 09 November 2025, 10:00	Sunday 16 November 2025, 08:00	55.88	38.29	56.43	54.14
ANT-3	Sunday 09 November 2025, 11:00	Sunday 16 November 2025, 08:00	54.63	41.88	52.43	50.57
PER41	Sunday 09 November 2025, 12:30	Sunday 16 November 2025, 08:30	58.57	45	59.67	56.33
Iuku	Monday 10 November 2025, 09:30	Thursday 20 November 2025, 09:00	57.55	45.91	54.00	46.60
Hururu	Monday 10 November 2025, 11:00	Thursday 20 November 2025, 10:00	57.45	47.27	54.70	43.30

Data quality checks identified limited exclusion periods at two monitoring locations due to equipment-related issues. At Herd Base 'M Block' Accommodation, a short period on Wednesday 05 November 2025 (06:15–06:45) was excluded to allow replacement of a faulty battery cable. At PER41, several exclusion periods were applied due to unusually high maximum noise levels attributed to a periodic equipment fault: Tuesday 11 November 2025 (03:45–07:30), Friday 14 November 2025 (14:30) to Saturday 15 November 2025 (06:00), and Saturday 15 November 2025 (14:30) to Sunday 16 November 2025 (08:30). No other monitoring locations required data exclusion, and no major calibration drift was recorded at any site.

Baseline vibration conditions across the terrestrial Project area are characterised by a remote, rural setting with very low existing anthropogenic vibration. The environment is dominated by natural processes such as river flow, seasonal flooding and sediment movement rather than mechanical ground disturbance. No blasting has occurred historically, and none is required for the Project, and there are no vibration-intensive baseline activities in PRL-15, the Purari River, or at Hou Creek. Communities and other sensitive human receptors are located several kilometres from proposed dredging, construction and processing activities, well beyond distances at which low-energy vibration would be perceptible. With the exception of Pokore Hamlet which is located under 1 km from the CPF site. There is no vibration-sensitive infrastructure or heritage fabric proximate to works, and previous aggregate extraction, river dredging and construction activities in the area (notably between 2010 and 2014) were undertaken without reported vibration complaints or damage, indicating a low baseline sensitivity to vibration effects.

6.6.3 Terrestrial Noise and Vibration Impact Assessment

This section summarises predicted terrestrial noise impacts for each key Project component, based on the EIS (2019), EIS Addendum (2024), and supporting specialist studies. It focuses on noise impacts on human receptors. Noise impacts to ecological receptors are covered in Section 6.17 (Terrestrial Biodiversity) and 6.18 (Marine Biodiversity).

Central Processing Facility - Construction

A range of planned construction activities of the CPF will generate noise, many of which would occur simultaneously and at varying levels of intensity. Therefore, it is difficult to accurately predict construction noise emissions throughout the entire construction period. The EIS Addendum (2024) therefore modelled construction noise for two representative worst-case scenarios for the new CPF location (P3):

1. Construction Scenario 1 (CS1): early works (clearing, earthworks, excavation, concreting).
2. Construction Scenario 2 (CS2): later works (structural erection, piling, mechanical installation).

Noise emissions assume all major equipment operating concurrently at full load, with a conservative 3 dBA de-rating applied to reflect real-world duty cycles. Key noise sources include excavators, screens, crushers, dozers, graders, dump trucks, concrete plant, cranes, pneumatic tools and piling equipment.

Sensitive receptors assessed (EIS Addendum 2024) and the relevant distances from the CPF:

1. Pokore Hamlet (0.7 km SE)
2. Poroi 1 Village (3.8 km S/SW)
3. Purari Airstrip House (5.8 km SW)
4. Ne'ea Creek (9.9 km W)
5. Herd Base (0.8 km E)

The predicted impacts from CPF construction on sensitive receptors was as follows:

Under neutral propagation:

- Noise levels meet long-term construction limits (55 dBA) at all receptors except Pokore Hamlet, which records values up to approximately the low-50s dBA for CS1 and CS2.
- Night-time limits (45 dBA) are exceeded at Pokore Hamlet.

Under enhanced propagation (inversion / favourable wind):

- Slight increases at all receptors, with continued exceedances at Pokore Hamlet.
- All other receptors remain below criteria.

Vibration at the CPF and associated infrastructure (including the MOF, COF, camps and utilities) will arise from routine construction earthworks, cut-and-fill activities and the operation of mobile and stationary plant during construction and operations. These sources generate low-energy, continuous or intermittent vibration that is confined to the immediate CPF footprint. No blasting or high-impact vibratory activities are proposed, and the CPF is located at substantial distance from villages and other sensitive receptors, with the exception of Pokore Hamlet which is less than 1 km from the CPF. As a result, vibration levels will attenuate rapidly and are not expected to be perceptible beyond the site boundary. Vibration impacts to human receptors, buildings and cultural heritage are therefore assessed as negligible.

Export Pipeline – Orokolo Bay Coastline – Construction

Construction noise will be generated during the laying of the export pipeline. Noise modelling for the EIS (2019) modelled potential impacts associated with the export pipeline shore crossing at Orokolo Bay. Modelling considered site preparation, bulk earthworks, trenching, pipe-laydown and installation activities.

As part of the modelling, the following villages were identified as representing sensitive receptors:

1. Iuku
2. Iuku East
3. Mareke
4. Mareke West (closest to the shore crossing, located approximately 250 m away)

The impacts predicted from shore crossing of the export pipeline were described as follows:

- All receptors comply with long-term (55 dBA) construction limits except three properties at the western edge of Mareke Village.
- Under enhanced propagation, exceedances of the long-term limit are only 2 dBA, which is barely perceptible.
- Short-term limits remain compliant at all times.

As the predicted minor excess of the lower noise management target will only occur during worst case propagation conditions, it is highly unlikely that the occupants of the three dwellings at the western edge of Mareke Village will be adversely affected during the scheduled construction works. However, it is recommended that advance notification is provided to occupants of both Mareke and Iuku Villages to inform them of the anticipated nature, timing, and duration of the works, particularly when the louder activities are scheduled (such as the initial ROW clearance works which will require the use chainsaws, wood chippers, and heavy mobile plant such as dozers, graders, and excavators).

Vibration along pipeline corridors will be generated by excavation, trenching, drilling operations and vehicle movements. No vibration-sensitive receptors are located adjacent to these corridors, and no blasting is proposed. Consequently, vibration impacts to communities, infrastructure and cultural heritage are assessed as negligible.

Dredging Activities – Purari River – Construction

Airborne noise from dredging is not well-documented. GHD (2009) completed a noise assessment for a dredging project in Victoria, Australia, which considered medium and large cutter suction and backhoe dredgers in the assessment with supporting tugs and barges. Noise levels, under neutral noise propagation conditions, were predicted to be 55 dBA approximately 250 m from the dredge and decreased with distance. Similar, if not lower, noise levels are assumed for dredging on the Purari River, given that small cutter suction dredgers will be used and that no tug is required.

Noise levels experienced by sensitive receptors along the Purari River will depend on the local terrain, weather. Most receptors are distant or shielded and impacts therefore are expected to be low.

Vibration from dredging arises from cutter suction dredgers, backhoe dredgers, and associated support vessels. These activities generate low-level, temporary vibration that is confined to the immediate dredging area and occurs only for the duration of active dredging. Vibration effects overlap with underwater noise considerations and are not a dominant or injurious stressor. No vibration impacts are expected for onshore receptors due to distance and rapid attenuation, and any disturbance to aquatic fauna is short-term, localised and reversible.

Aggregate Sourcing – Hou Creek - Construction

Vibration associated with the Hou Creek aggregate dredging and processing base will be generated by mechanical dredging using a backhoe mounted on a spudded pontoon, along with barge loading/unloading, haulage trucks, and crushing and screening equipment within the base area. These activities produce minor, localised vibration restricted to the riverbed and immediate shore. The absence of blasting or impact piling limits vibration intensity, while saturated alluvial sediments further attenuate vibration propagation. Given the several-kilometre separation between the Hou Creek base and nearby villages, no perceptible vibration impacts to communities or structures are expected. Vibration impacts are therefore considered negligible.

Horizontal Directional Drilling (HDD) – Caution Bay and Purari River - Construction

The entry point for HDD will be located within the PNG LNG Plant at Caution Bay. Typical noise emissions associated with HDD, which have not been previously assessed, primarily relate to the 250 to 400-t rig that will drill horizontally to a depth of about 30 m underground. HDD also includes the requirement for an offshore jack-up barge that will be set up for pipeline pull assist. Noise from 250–400 t drill rigs is expected to comply with criteria at all receptors (Papa/Boera villages).

Regarding the Purari River crossing, the proposed location has been moved due to the change in location of the CPF, which will require minor re-routing of the pipelines across the river. As per EIS Addendum (2024), investigations are being undertaken in order to confirm that this location is suitable for HDD based on ground conditions for drilling platforms. It should also be noted that other trenchless approaches remain under consideration today.

Updated noise modelling will occur once equipment lists are finalised.

HDD methods result in relatively low ground vibration compared to traditional open-cut approaches, and construction activities are linear and transient, limiting exposure duration at any one location.

Central Processing Facility - Operations

CPF operational noise modelling assessed three scenarios (EIS Addendum, 2024):

1. OS1: Normal operations
2. OS2: Partial shutdown (acid gas to HP flare)
3. OS3: Emergency operations (HP flare + gas-assisted flare)

Operational equipment includes gas turbines, compressors, fin-fans, pumps, boilers, thermal oxidiser and flares.

The predicted Impacts associated with CPF operations per scenario were determined to be as follows:

- Normal operations (OS1)
 - o Noise complies with daytime and night-time criteria at all receptors under both neutral and enhanced propagation.
 - o Pokore Hamlet remains the most exposed of the community receptors.
 - o Abnormal / flaring conditions (OS2, OS3).
- Flaring dominates all noise emissions during these scenarios.

- o Exceedances of both daytime (55 dBA) and night-time (45 dBA) limits occur at all receptors except Ne'ea Creek (night only).
- o Exceedances range from 3–26 dBA (day) and 5–36 dBA (night).
- o These events are expected to occur 2–3 times per year, typically 4–6 hours in duration and not exceeding 24 hours.

Decommissioning / Closure

Decommissioning noise and vibration magnitudes are anticipated to be lower than those described for construction and therefore not expected to create significant adverse impacts.

6.6.4 Terrestrial Noise and Vibration Mitigation

Noise and vibration emissions will be minimised by implementation of the Noise & Vibration Management Plan (2024), hereafter referred to as Project's Noise & Vibration MP (2024).

Table 6-16 below describes Project mitigation measures. In addition, the potential need to physically resettle Pokore Hamlet [SM031] is pending further noise assessments. Should physical displacement be necessary, the Project will follow IFC PS5 on Land Acquisition and Involuntary Resettlement and obtain FPIC from both affected households and, where relevant, host communities in accordance with IFC PS7 on Indigenous Peoples (IPF 2026).

Table 6-16: Mitigation measures - Terrestrial noise and vibration

Impact	Mitigation code (As in MP)	Description	Source document
All Construction Activities	EM046	Limit construction work, where practicable, to daytime hours.	<i>EIS/ Upstream CESMP; 2019</i>
	ED030	Fixed or mobile equipment will be used and/or located considering people and other sensitive receptors.	<i>EIS/ Upstream CESMP; 2019</i>
	ED031	Minimise noise from machinery, plant and equipment, as far as practicable.	<i>EIS/ Upstream CESMP; 2019</i>
	ED019	All vehicles (including vessels and aircraft) and machinery, plant and equipment will be regularly maintained to the manufacturer's specifications; defective items will be removed from service until they are repaired.	<i>EIS/ Upstream CESMP; 2019</i>
	ED032	The Project will design its plant and undertake activities to comply with the applicable noise criteria.	<i>EIS/ Upstream CESMP; 2019</i>
	SEM002	The Project will prepare an updated stakeholder engagement plan for the Project's construction, operations and decommissioning phases, according to TotalEnergies' General Specifications and IFC PS1 and PS7. The updated stakeholder engagement plan will include the following key requirements: • Regular engagement with PACs on Project impacts, action plans and grievance mechanism. • Notification as early as possible to affected communities in advance of Project works, which describes the activities and how long they are expected to take. Particular focus is to be given to communities affected by project-induced in-migration. • A mechanism for enquiries and feedback. • Ongoing grievance and issues management.	<i>EIS/ Upstream CESMP; 2019</i>
Resettlement (not confirmed, see above)	EM053	The site selection process for resettling Pokore Hamlet will consider the results of the noise modelling to ensure that noise limits are not exceeded at the new site.	EIS Addendum, 2024

6.6.5 Terrestrial Noise and Vibration Residual Impacts

After application of the Project's Noise & Vibration Management Plan and associated controls, no unacceptable residual terrestrial noise and vibration impacts are anticipated. Residual effects during CPF construction are expected to be low to moderate, with occasional exceedances at Pokore Hamlet, particularly at night, due to its proximity. These are limited to specific activities and weather-enhanced propagation, and are managed through scheduling, equipment controls, and community notification. During operations, normal conditions meet all criteria, resulting in low residual impact, while abnormal flaring events may temporarily exceed limits at several receptors but occur infrequently and for short periods (typically 4–6 hours, 2–3 times per year). Other components such as pipeline shore crossing, dredging and HDD produce low or negligible residual terrestrial noise and vibration due to distance and very small exceedances (≤ 2 dBA).

Noise modelling is planned to be updated by the EPC contractor in charge considering latest project design and mitigation and the 2025 updated baseline. Monitoring will be completed during construction and periodically during operation to ensure levels at receptors are acceptable, and within the Project limits.

6.6.6 Underwater Noise and Vibration Introduction

Due to the difference in the behaviour of noise and vibration underwater compared to above water - as well as the different receptors - it is important to distinguish between the two. Sound travels around 4.3 – 5 times faster and farther than in air due to water's higher density, although above water sounds will sound muffled below water.

There are several sensitive aquatic fauna receptors including large cetaceans, dugongs, various fish (including sharks), turtles, and crocodiles in the PAoI. The following section will focus on the types of activities that will occur onshore and possibly impact the aquatic fauna present, based upon the types of noise/vibration as a result of the activities, as well as the hearing frequency ranges and behaviour of the aquatic fauna in the presence of potentially disturbing underwater noise. The data from this section has been informed by the EIS Vol. 3 Part 1 Underwater Noise Modelling for Impact Assessment (2019). An underwater noise modelling study (Underwater Noise Modelling Study – Nearshore Noise and Vibration Assessment, henceforth Underwater Noise Modelling Study (2025) was also undertaken in 2025 and the findings are summarised in the FEED Changes EAR (2025).

6.6.7 Underwater Noise and Vibration Baseline

An assessment of background levels of underwater noise in the Gulf of Papua, Caution Bay, Orokolo Bay, and river transport corridors in the Purari River delta, is provided in the EIS (2019). Results are shown in the Table 6-17 below.

The Underwater Noise Modelling Study (2025) adopted ocean ambient noise spectral components for the North Atlantic Ocean as representative of ambient conditions in the Gulf of Papua and Caution Bay. Ambient noise levels typically range:

- o From as low as 80 dB re 1 μ Pa for areas with few shipping movements and calm sea surface conditions.
- o Up to 120 dB re 1 μ Pa for areas with moderate to heavy remote shipping traffic and medium to high wind conditions.

Table 6-17: Summary of underwater noise levels and key noise sources at assessment locations (Source: Underwater Noise Modelling Study, 2025)

Project Area	Assessment Location	Water Depth (m)	Key Noise Sources	Baseline Noise (dB re 1µPa rms*) – Mean	Baseline Noise Range
Offshore export pipeline route	1 (Caution Bay)	30	Soniferous fish, snapping shrimp, commercial shipping traffic including LNG carriers and tugboats	110	90 to 161
Offshore export pipeline route	2 (south of Kerema)	80	Wind, waves, snapping shrimp, barges and trawlers	105	75 to 127
Offshore export pipeline route	3 (south of Ihü)	50	Wind, waves, rainfall, soniferous fish, snapping shrimp, marine mammals, barges and community vessels	110	85 to 163
Offshore export pipeline route	4 (Orokolo Bay)	12	Wind, waves, rainfall, soniferous fish, snapping shrimp, marine mammals, barges and community vessels	115	80 to 165
River transport corridors (Puarí River delta)	5 (Aivei Passage)	6	Rainfall, soniferous fish, marine mammals, barges and community vessels	110	75 to 175
River transport corridors (Puarí River delta)	6 (Port Romilly)	8	Rainfall, soniferous fish, barges and community vessels	115	80 to 178
PRL-15	7 (Purari River)	6	Wind, rainfall, soniferous fish, barges and community vessels	120	75 to 170

Based upon a baseline assessment of sensitive aquatic fauna from EIS Vol. 1 Ch. 7 Existing Environment – Terrestrial (2019), hereafter referred to as EIS Existing Environment – Terrestrial (2019), and EIS Vol. 1 Ch. 8 Existing Environment – Marine (2019), hereafter referred to as EIS Existing Environment – Marine (2019), the following fauna groups are present in the PAol, along with their hearing frequency ranges (range dependent on species):

- Cetaceans: 12 Hz – 150 KHz
- Dugongs: 300 Hz – 90 KHz
- Fish: 40 Hz – 100 KHz
- Turtles: 50 Hz – 1600 Hz
- Crocodiles: 50 Hz – 6 KHz

There was additionally an assessment of the types of sound that may be present in the PAol. The table below details the noise type, frequency and source level of the noises present in the PAol based upon the activity type. The proposed construction activities at the Logistics Base (primarily onshore activity) are:

- Construction of a platform for buildings, container yard and aggregate buffer stockyard.
- Rock dumping during installation of concrete ramps for landing craft tank (LCT) vessels and barges.
- Outer quay sheet pile wall comprising interlocked individual Z-shaped sheet piles.
- Inner quay 550 mm diameter steel tube anchor piles and tie-back rods to sheet pile wall.
- Dredging of riverbed sediments adjacent to the quay.

Similar types of activities would occur for the MOF construction at CPF.

Table 6-18: Underwater noise levels per activity type (Source: EIS 2019)

Activity	Activity	Noise Type	Frequency	Source Level
Piles driving at river quay on Purari River	Impact hammer pile driving of sheet piles	Impulsive noise, transient broadband noise	10–600 Hz	205 dB re 1 $\mu\text{Pa}_{\text{rms}}$ 220 dB re 1 μPa_{pk} 190 dB re $\mu\text{Pa}^2\cdot\text{s}$
	Vibratory hammer pile driving of sheet piles	Non-impulsive, transient and continuous broadband noise	20-40 Hz	175 dB re 1 $\mu\text{Pa}_{\text{rms}}$ 190 dB re 1 μPa_{pk} 175 dB re $\mu\text{Pa}^2\cdot\text{s}$
River dredging at river quay on Purari River	Backhoe dredger	Non-impulsive, continuous noise during dredging	100-500 Hz	180 dB re 1 $\mu\text{Pa}_{\text{rms}}$
Nearshore trenching and piling in Orokolo Bay	Land-based crane fitted with impact hammer driving sheet piles in very shallow water	Impulsive noise, transient broadband noise	10-600 Hz	180 dB re 1 $\mu\text{Pa}_{\text{rms}}$ 205 dB re 1 μPa_{pk} 170 dB re $\mu\text{Pa}^2\cdot\text{s}$
River vessel traffic and transportation	Project vessels plying river main channels	Non-impulsive, continuous broadband noise	20-1,000 Hz	170 dB re 1 $\mu\text{Pa}_{\text{rms}}$
Offshore construction	Pipelay barge maintained in position by anchors	Non-impulsive, continuous broadband noise	10-1,000 Hz (up to 10 kHz)	183 dB re 1 $\mu\text{Pa}_{\text{rms}}$
	Concrete mattress installation or rock dumping at PNG LNG Gas Pipeline crossing	Non-impulsive, continuous broadband noise	20-1,000 Hz	183 dB re 1 $\mu\text{Pa}_{\text{rms}}$
Marine vessel traffic and transportation	Project vessels plying offshore waters of the Gulf of Papua	Non-impulsive, continuous broadband noise	20-1,000 Hz	175 dB re 1 $\mu\text{Pa}_{\text{rms}}$

6.6.8 Underwater Noise and Vibration Impact Assessment

Comparing the projected activities to the baseline data, there is estimated to be a 3.5 fold increase in daily vessel traffic at the nominal single point in the river (based upon a change from 1 vessel every 20 hours to 1 vessel every 6 hours). The baseline range of underwater noise is between 75 and 170 dB re 1 $\mu\text{Pa}_{\text{rms}}$ in the Purari River. The background upper range value of 170 dB re 1 $\mu\text{Pa}_{\text{rms}}$ accounts for passing commercial ships, landing craft vessels and local community motor-driven boats. Average underwater noise levels during Project construction and operations are expected to exceed the baseline average of around 120 dB re 1 $\mu\text{Pa}_{\text{rms}}$ due to the 3.5 fold increase as mentioned previously but remain within the baseline upper range. Vibration from dredging arises from cutter suction dredgers, backhoe dredgers, and associated support vessels. These activities generate low-level, temporary vibration that is confined to the immediate dredging area and occurs only for the duration of active dredging. Vibration effects overlap with underwater noise considerations and are not a dominant or injurious stressor. No vibration impacts are expected to cause disturbance to aquatic fauna and any disturbance is short-term, localised and reversible.

The potential impacts on the aquatic fauna groups are detailed below, based upon whether the noise/vibrations may disturb/impact behaviour (column 3), and/or cause damage (column 4). Some acoustic damage threshold exceedances are either unavailable, or the acoustic disturbance present may cause the animal to move out of that area and thereby avoid damage (both scenarios marked N/A). The acoustic damage threshold exceedances marked in the table below take into account all types of noise present during that activity. If no threshold exceedances, then 'Not exceeded', and if any threshold exceedances, then 'Exceeded'.

Table 6-19: Threshold exceedances met or not, based on activity type and aquatic animal type (EIS, 2019)

Activity type	Aquatic fauna group*	Acoustic disturbance threshold exceeded?	Acoustic damage threshold exceeded?
Pile driving at the River Quay	Freshwater Fish	Exceeded	Exceeded
	Freshwater Turtles and Crocodiles	Exceeded	N/A
River dredging	Freshwater Fish	Exceeded	Not exceeded
	Freshwater Turtles and Crocodiles	Exceeded	Not exceeded
Nearshore Trenching and Piling	Cetaceans	Exceeded	N/A
	Dugongs	Exceeded	Not exceeded
	Sea Turtles and Crocodiles	Exceeded	Not exceeded
	Fish	Exceeded	Not exceeded
River vessel traffic and transport	Fish	Exceeded	Not exceeded
	Freshwater Turtles and Crocodiles	Not exceeded	Not exceeded
Offshore Construction - Pipelaying	Cetaceans	Exceeded	Not exceeded
	Dugongs	Exceeded	Not exceeded
	Sea Turtles and Crocodiles	Not exceeded	Not exceeded
	Fish	Exceeded	Not exceeded
Marine Vessel Traffic	Cetaceans	Exceeded	Not exceeded
	Dugongs	Exceeded	Not exceeded
	Sea Turtles	Not exceeded	Not exceeded
	Fish	Exceeded	Not exceeded

* To date there has been no project surveys that identifies cetaceans in the river besides the estuary. In any case the noise from the activities in the river will exceed the threshold of disturbance to cetaceans.

Vibration associated with offshore and nearshore infrastructure, including PLEM and riser installation, is limited primarily to piling activities on the seabed. These effects are assessed principally as underwater noise rather than terrestrial ground vibration. Vibration is not transmitted to onshore receptors, and marine fauna disturbance is temporary and managed through established marine construction controls such as exclusion zones and scheduling. No adverse vibration impacts to onshore environments or communities are expected

6.6.9 Underwater Noise and Vibration Mitigation

In addition to the general noise mitigation measures identified in Section 6.6.4, specific mitigation for underwater noise is provided Table 6-20 below as per the Project's Noise & Vibration MP (2024).

Table 6-20: Mitigation measures – Underwater noise and vibration

Impact	Mitigation code (As in MP)	Description	Source document
Jetty construction; underwater construction, including dredging, piling, trenching and offshore pipeline installation	EM039	Provide for a 'soft start' for impact hammer piling activities to allow fauna nearby to move away before sound levels reach maximum levels.	<i>EIS/ Upstream CESMP; 2019</i>
	EM040	If noise-sensitive aquatic species are sighted during piling, initiate shutdown and stop operations until the animal leaves the noise exclusion zone or a set period has passed; visually monitor for dead or injured aquatic fauna.	<i>EIS/ Upstream CESMP; 2019</i>

6.6.10 Underwater Noise and Vibration Residual Impacts

Residual underwater vibration and noise impacts arising from piling, dredging, trenching, pipelaying and vessel traffic are assessed as low, temporary and not significant following the application of mitigation measures. Underwater vibration effects are closely linked to underwater noise and are generally confined to short-term, localised disturbance in the immediate vicinity of active works.

While underwater noise levels may exceed behavioural disturbance thresholds for some aquatic fauna groups during certain activities, injury thresholds are rarely exceeded and risks are effectively minimised through soft-start procedures, trained fauna observers, shutdown protocols and vessel-speed controls. Increases in vessel traffic (approximately 3.5-fold) will incrementally elevate average underwater noise levels; however, these remain within the upper range of the existing baseline, which already reflects commercial and community river and marine traffic.

Given the short duration and spatially limited extent of construction noise and vibration sources, and the mitigation and monitoring framework in place, any residual underwater vibration and noise effects are expected to be localised, reversible and without population-level consequences for riverine and marine fauna. Monitoring during construction and periodic operational checks will be undertaken to confirm that levels at receptors remain acceptable and within Project limits.

6.7 Soils and Geology

6.7.1 Introduction

This section presents a synthesis of Project documentation relating to geology and soils. This includes a synthesis of previous Project assessment, and potential Project impacts and mitigation measures pertaining to soils and geology. This section also presents residual impacts and their significance as assessed in previous Project documentation.

The Project is committed to managing impacts to geology and soils in line with international best practice, including IFC PS 1, 3 and 6, as well as IFC and World Bank Group EHS Guidelines for Onshore Oil and Gas development.

6.7.2 Baseline

A geology, terrain and soils baseline, encompassing PRL-15, including the production, processing and related facilities, and the onshore export pipeline corridor ('the study area'), was produced in 2017 to inform the EIS (2019). The geology, terrain, and soils of the Project area have been investigated through a combination of desktop review, fieldwork, and laboratory analysis. The following baseline subsections provide key details from this baseline study.

Regional Tectonics

As per the EIS (2019) the Elk-Antelope gas field is located within central PNG in the southern foothills of the Central Range within the Papuan Fold and Thrust Belt and the Aure Deformation Zone. The Central Range, or Central Highlands, is a 3,000 m high mountain belt that extends over 1,300 km and is up to 150 km wide. The Central Range has been formed as a result of collisions between the Pacific and Australian plates. Currently, the Pacific Plate is moving westward relative to a fixed Australian Plate with a convergent component across the New Guinea region. The differential motion between the Australian and Pacific plates is accommodated by four microplates: North Bismarck Plate, South Bismarck Plate, Woodlark Plate and the New Guinea Highlands block. Crustal deformation and seismicity are concentrated along these boundaries (Wallace et al. 2004; Williamson and Hancock 2005). See Figure 6-4

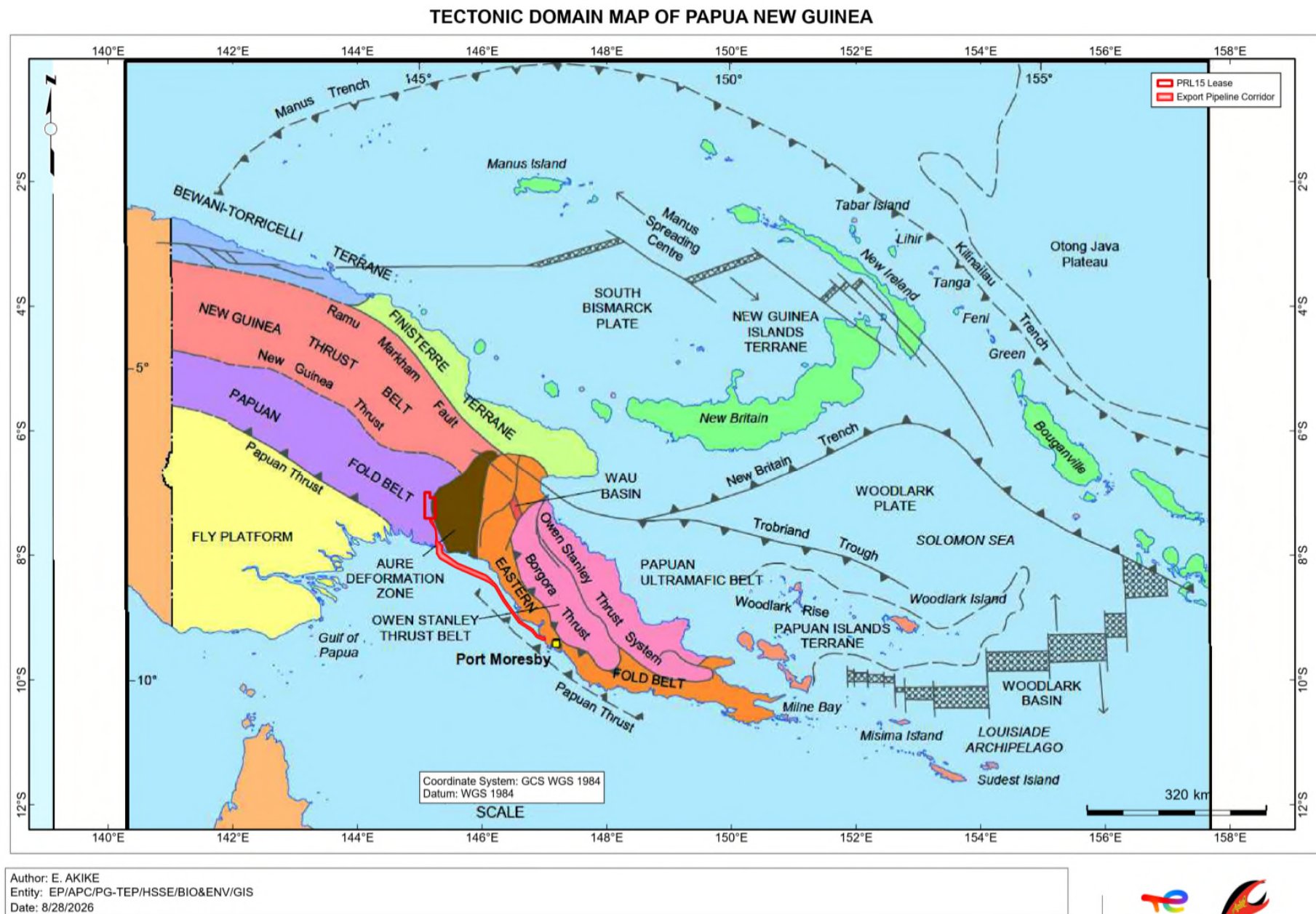


Figure 6-4: Tectonic domain map of Papua New Guinea (Williamson and Hancock, 2005)

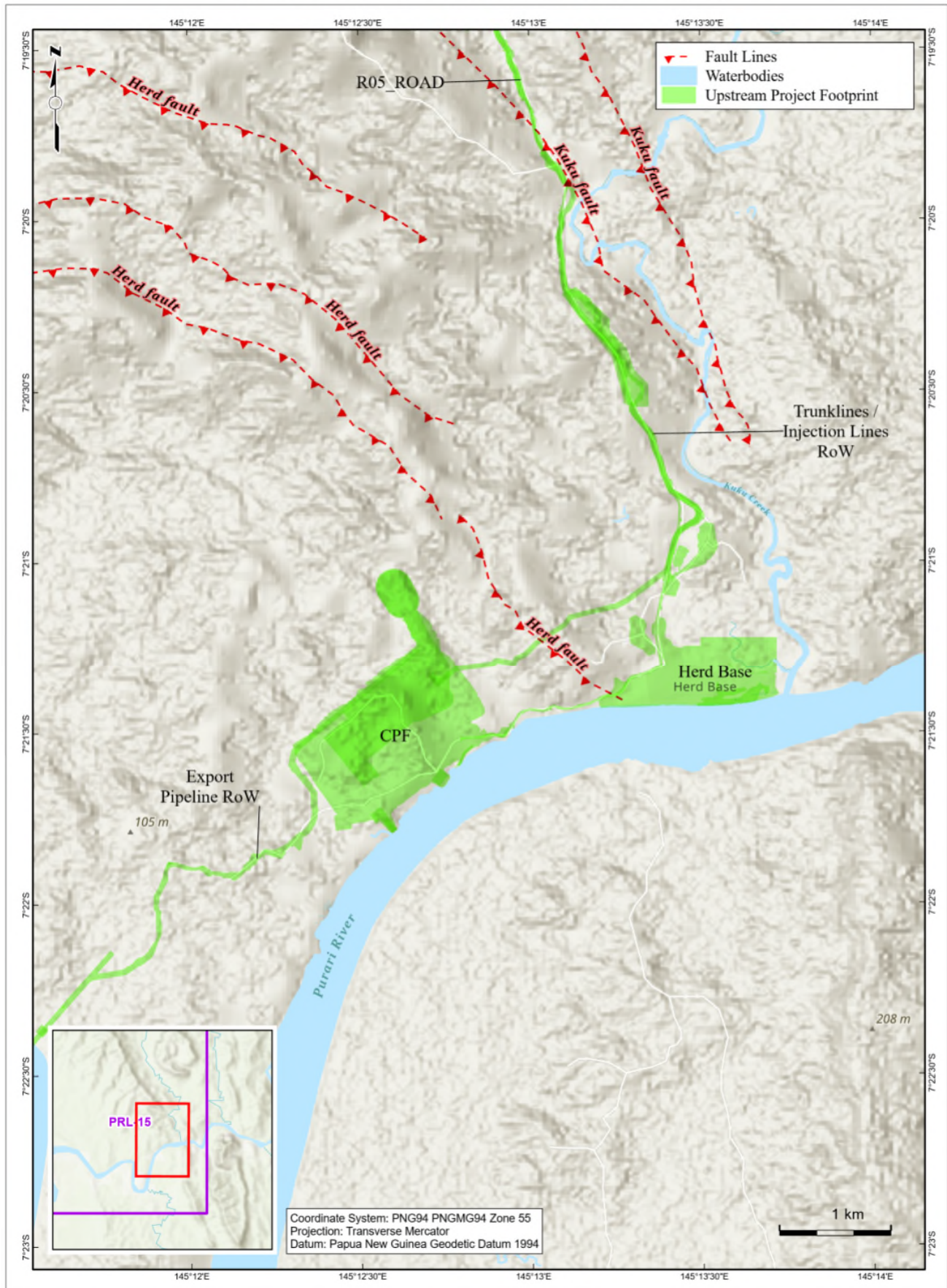
Structural Geology

The structural geology of the study area is dominated by north-south trending features of the Papua Fold and Thrust belt. The area is characterised by a complex sequence of 'narrow anticlines separated by broad synclines'. The structural features in the area are expressed in the landform with the location of faults and folds correlating with the occurrence of strike ridgelines. Named structural features include:

- Orloli and Hororo anticlines – occurring along the onshore export pipeline corridor
- Bevan and Pemani faults – to the east of the study area (not crossed by onshore export pipeline corridor)
- Kuku fault – occurring in the mid-western section of PRL-15
- The Mena fault system
- The Horsetail anticline fault
- The Era basement fault.

The geological structures within the study area are considered to have moderate to high-risk fault hazards (see Figure 6-5 for locations of fault lines in relation to Project components). Where faults remain active, they have potential to represent geohazards to Project infrastructure both directly through displacement and differential movement and indirectly through destabilisation and/or initiation of landslides or mass movement.

MAP OF BASELINE LOCATIONS OF FAULT LINES



Entity: EP/APC/PG-TEP/BSE/GIS
 Author: E. AKIKE
 Date: 8/31/2026



Figure 6-5: Locations of fault lines (Source: EIS Addendum, 2024).

Geomorphology and Terrain

Bedrock and superficial deposits were mapped, identifying specific lithologies such as alluvial deposits and back plains. Terrain documentation included landform patterns, slope characteristics, and current land use.

A basic stratigraphy for the study area compiled using information from Pieters (Pieters, P. 1980. The Geology of Kikori, PNG.) and GHD (GHD, 2015. Antelope 6 – Environmental Impact Assessment and Environmental Management Plan) is included below in Table 6-21.

Table 6-21: Basic stratigraphy of the study area

Age	Name and Thickness	Description
Holocene	Quaternary Sediment <100m	Variable depending on parent geology and location in study area. Accumulations within river valleys and creek lines. Unconsolidated coarse sands and gravels in upper catchments with fine black to dark grey sands and silts in the Purari River basin.
Pliocene to Pleistocene	Era Beds <2,000m	Sandstone, siltstone and mudstone with rare coal and conglomerate. Commonly carbonaceous. Blue to grey and brown when weathered.
Uppermost Miocene to Pliocene	Orubadi Beds <2,400m	Mudstone, siltstone, sandstone, minor conglomerate and rare calcarenite and limestone breccia. Blues to grey and brown in more calcareous areas. Fine to medium bedded and occasionally massive.
Upper Oligocene to lower Miocene	Kapau Limestone >1,000m	Cream to light brown; mainly thin bedded but occasionally massive limestone. Fossiliferous in places including fragments of corals, bivalves and gastropods. Reservoir rock, target of the gas exploration.

The above-mentioned geological characterisations are located within the ridge and ravine landforms of the study area.

The southwest corner of PRL-15 (including the proposed CPF area), the western edge of the onshore export pipeline corridor and the littoral plains and beaches are categorised as:

- Qa5 - Recent (Holocene) undifferentiated alluvial/fluvial sediments consisting of gravel, sand, silt, mud, carbonaceous mud, clay, minor peat, alluvial soils, alluvium and littoral deposits. This lithology is located on the alluvial plains of the Purari River and the beach ridges and plains towards the coast and may be up to 30m deep.

The predominant rock types encountered during field studies conducted throughout the study area are of sedimentary origin, including interbedded, mudstones, siltstones, sandstones, conglomerates, and limestone. Some evidence of volcanic lithologies was found in basaltic road base spread on access roads and drill pads. Carbonaceous sedimentary rocks in the form of carbonaceous mudstones and coal were found as detrital angular, cobble-sized particles in Oyomo Creek. Varying levels of structural deformation was observed in the field from relatively gently dipping strata to strongly faulted and folded materials.

The most commonly occurring rock types are well-indurated (hardened) mudstone, siltstone, sandstone and limestone often interbedded with layers of less indurated rock of similar lithologies. Although some dip slopes may appear very smooth and regular from an aerial perspective, on the ground they are mostly irregular owing to slumping and gullying. Low-relief (10 to 50 m) ridge and ravine landform is typical of the soft mudstone adjacent to the Purari River, occurring along the export pipeline corridor and in PRL-15.

Landslides and Slope Failures

As per the EIS Addendum (2024), the presence of active and historical landslides is common throughout the PRL-15 area because of the terrain nature and topography, together with tectonic activity and heavy rainfall acting as triggering factors.

PRL-15 and the eastern edge of the onshore export pipeline corridor are dominated by two geological formations:

- Tmup - the Pliocene Orubadi formation, constituted of mainly mudstone along with siltstone, minor sandstone, rare conglomerate and calcarenite, is generally carbonaceous and calcareous in places.
- TQe - the Plio-Pleistocene Era formation, consisting of lithic sandstone, siltstone, mudstone, minor conglomerate with regressive sequence from shallow marine to continental deposits and coal seams.

Earthworks may trigger landslide movement if not properly designed and managed. Slope failure analysis and mapping of landslides show that landslide susceptibility is high for Orubadi formation (Tmup1), moderate for Era formation (TQe) and low for undifferentiated alluvium (Qa5) (Fugro, 2019). The soil type at CPF site is TQe and therefore has moderate landslide susceptibility.

Rockfalls, Landslides and Debris Flow Geohazards

Rockfalls, landslides, debris flows and gullying are common geohazards for the study area, particularly within the ridge and ravine landform areas. These geohazards are triggered by large rainfall events, concentrated surface water drainage and seismic activity. If triggered, these geohazards can cause major land movement due to the topography and steeply dipping strata, which have weak, clay- rich rock masses interbedded with strong rock masses.

Soil Complexes and Soil Units

The study area has been divided into four soil complexes and separated using topo-sequence or terrain features to further identify the locations of soil units. The study area is dominated by entisol and inceptisol soil orders of soil complex 1. The classification of this land capability is Class VIII, meaning the soils and landforms have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, water supply catchment or to aesthetic purposes according to the United States Department of Agriculture (USDA) land capability classification (USDA 1961).

The inundated tidal flats, swamps and saturated alluvial soils are dominated by histosol soils of soil complex 4, which typically form under saturated conditions and have high organic matter in the upper layers. This soil complex is found along the coast and Purari delta in small sections of the proposed export pipeline corridor. These soils are below the mean high water mark and are considered potential acid sulphate soil (PASS) given their position in the landscape. The dominant limitation of these soils for use in agriculture is the fact they remain inundated for the majority of the time. The land capability of this soil complex is also considered Class VIII (USDA 1961).

Baseline Soil Conditions

Soil surveys used to inform the EIS (2019) were conducted in November 2016. The baseline reported that the study area is dominated by Entisol and Inceptisol soil orders which are considered poorly formed soils with no to limited soil pedological development. This is due to either erosion in the ridge and ravine areas in PRL-15 and the eastern edge of the onshore export pipeline corridor, preventing soil from developing over the bedrock parent material, or the young age of the soil, as in the depositional profiles of the alluvial plains and beach landforms in the south-western parts of PRL-15 and the western edge and southern extremities of the onshore export pipeline corridor. The inundated tidal flats, swamps and saturated alluvial soils are dominated by Histosol soils, which typically form under saturated conditions and have high organic matter in the upper layers.

The soils within the ridge and ravine terrain and mapped as Soil Complex 1, ranged from moderate to well drained, had moderate cation exchange capacity with low nitrogen levels and exhibited stable aggregates. However, the frequency and intensity of rainfall, combined with the sloping landform of the ridge and ravine terrain, was observed to have caused high levels of water-induced erosion.

Soils within the alluvial plains landforms and mapped as Soil Complex 2, ranged from moderate to poorly drained, had low to moderate cation exchange capacity, depending on the texture in each layer, low nitrogen levels and exhibited stable aggregates. Evidence PASS was observed at sites 22 and 22A near the coast (see Figure 6-6).

The sandy soils of Soil Complex 3 within the beach ridges and beach plains are typically well drained in the upper layers, however frequent waterlogging in the subsoil was observed given the low elevation. The soils often had low cation exchange capacity and very low nitrogen, and if able to form aggregates, these were stable. However, the majority of these soils were sandy with no structure.

The inundated soils within permanent swamps and drainage flats were mapped as Soil Complex 4. These soils were not sampled, however due to the virtual permanent waterlogging status of these soils they were defined as Histosols and Hydraquents.

The land capability of the study area is categorised as Class VIII in the ridge and ravine terrain as well as the frequently flooded alluvial plains and beach landforms. This Class VIII land capability is essentially unsuitable for broad scale agriculture or grazing. Only areas within Soil Complex 2, which were the better drained areas of the alluvial plains, exhibited the possibility of some grazing and tree crops with areas of Class VI land capability evident. All activities associated with subsistence garden endeavours were observed to rely on high levels of human intervention and inputs such as creating artificial drainage and mounding to provide a suitable growing medium.

Potential Acid Sulphate Soils (PASS) Screening

The results of PASS screening tests on 22 samples from 9 targeted sites indicated that the study area contains several soil units which may be prone to releasing sulfuric acid if disturbed or drained.

The risk of PASS being present in the majority of coastal soils within the study area is considered high. The screening concluded that the study area contains several soil complexes, which may be prone to releasing sulfuric acid if disturbed and exposed to the atmosphere. The soil complexes at highest risk of acid generation are soil complexes 2, 3 and 4, all of which are located in the lower lying areas which experience frequent inundation. The testing also indicated moderate risk levels of acid generation from within the subsoils of the nine sites tested.

Soil Metal and Hydrocarbon Screening

For the Upstream Geology Terrain & Soils Baseline (2017), soil heavy metals analysis was conducted at 27 sites (Figure 6-6) across four horizons to 100cm below ground surface. Metal concentrations in soil samples were analysed to establish background levels for future comparison. The ecological soil screening levels (Eco-SSLs) and the human health-based screening levels (ANEP 2013) were used as guides to assess the status of current background levels. Metals analysed included Aluminium, Arsenic, Barium, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Selenium, Silver, Strontium, Tin, Vanadium, Zinc, and Mercury. The majority of samples were well below the National Environment Protection Measures (NEMP) (ANEP 2013) health-based screening levels across all metals, however there was wide variation when compared to the US EPA Eco-SSLs. Levels of chromium, selenium, vanadium and zinc in two samples (23 and 27) were relatively higher than others and notably higher than the average concentration of world soils. It is not known if the source of these metals is related to anthropogenic activities or natural conditions.

Soil hydrocarbon screening was also conducted for Total Petroleum Hydrocarbons (TPH), total recoverable hydrocarbons (TRH) and Benzene, Toluene, Ethylbenzene, Xylenes and Naphthalene (BTEXN). The analysis

determined that there was no evidence of hydrocarbon contamination at any of the soil sampling sites and that levels of TPHs and BTEXN in all samples were below the limits of reporting and also below Eco-SSLs.

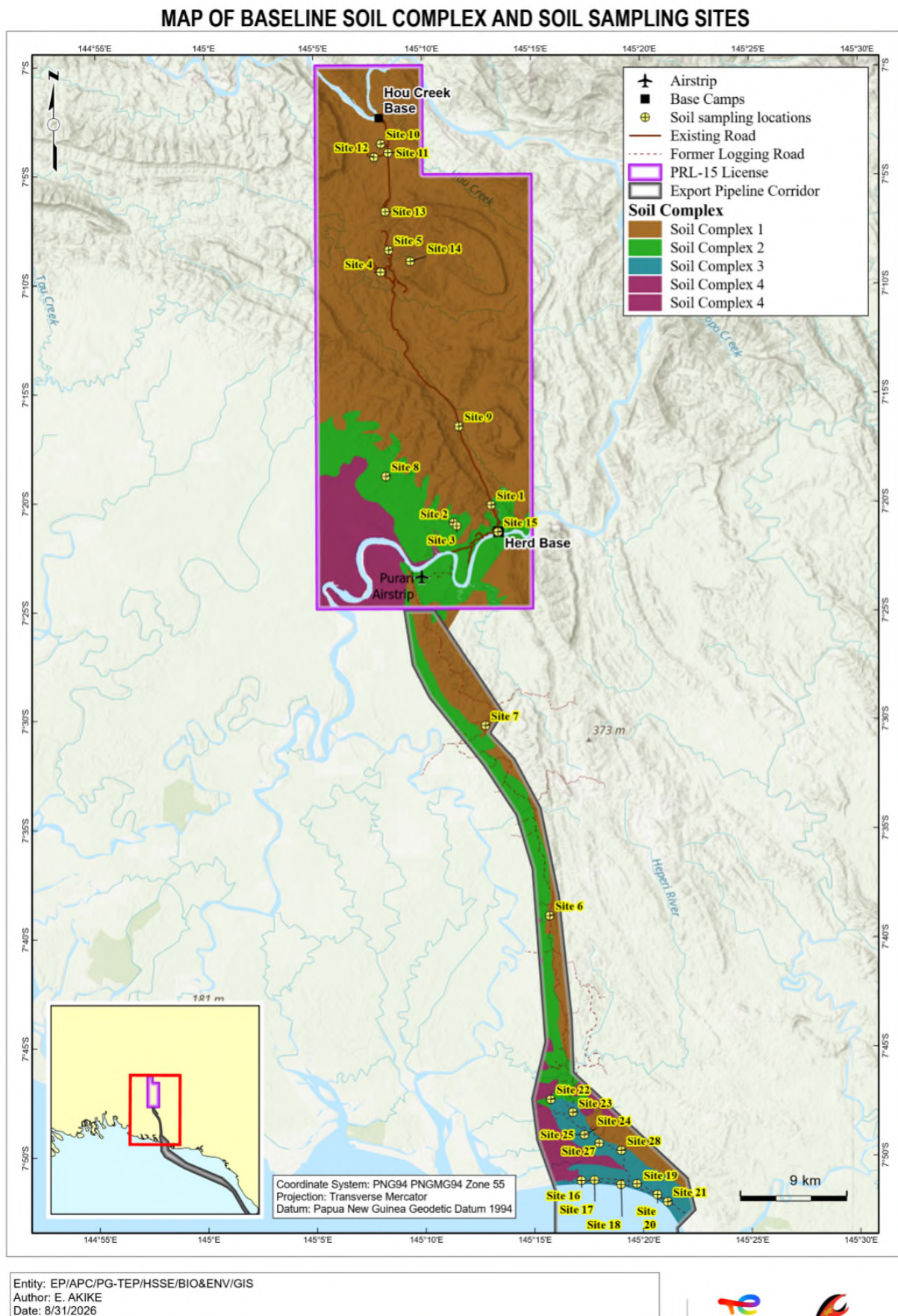


Figure 6-6: Soil complex and soil sampling sites (Source: Upstream Geology Terrain & Soils Baseline (2017))

6.7.3 Impact Assessment

As per the EIS Addendum (2024), potential impacts to geological landform and soils relate to:

- Landform destabilisation causing landslides or mass movement
- Degradation of soil capacity.

The CPF location is on the alluvial plain of the Purari River at the foot of the ridge and ravine landform in PRL-15. This river plain landform is quite stable in regard to large landslides or mass movements due to its gently undulating to flat topography. However, localised excavation, filling, or cut and fill of the ground surface associated with construction, operations and decommissioning may potentially cause some destabilisation.

Limited landslide zones have, however, been encountered in the area of the CPF P3 site due to the presence of competent subsoils such as gravel, pebble, and mudstone on slopes. The site is considered to have favourable conditions regarding landslide hazards, and any areas identified as prone to potential landslide will be removed during the cut activities of the site preparation (as described in the EIS Addendum, 2024).

The sensitivity of the landform to destabilisation was categorised to be Medium in the EIS (2019), and this sensitivity ranking also applies to the CPF P3 site.

Construction

Project activities, including the construction of wellpads, the CPF, and the onshore export pipeline corridor, will result in permanent land conversion and soil disturbance. All excavation activities pose risks related to soil exposure. Key geotechnical risks identified include erosion potential (particularly streambank erosion), the disturbance of highly erodible or dispersive soils, and drainage issues associated with clay-rich, low-permeability soils.

Excavation and stockpiling of PASS could lead to acidic drainage conditions with potential for impacts on surface and groundwater. Substantial volumes of aggregate will be required for construction (see 6.9.3 below) on Resource Management for further detail).

During construction key risk areas for accidental hydrocarbon and chemical spills are the CPF and Herd Base where the largest volumes of fuels, oils and chemicals will be stored and handled; however, accidental spills and leaks, including leaks of reservoir fluids from flowline/trunklines or condensate leaks from the onshore export pipelines, may potentially occur in all areas of Project activities (EIS, 2019).

As per the FEED Changes EAR (2025) there is also the potential for adverse effects on chemical properties at Caution Bay, as a result of frac out during HDD works.

Operation

The location of the CPF is considered to have limited potential for landslides. Any unstable landslide zones will be removed during the cut, fill and grading activities to create the CPF platform foundation. In the vicinity of the CPF area, there are some slopes which do not exhibit landslide hazard due to the presence of competent subsoils such as gravel, pebble, and mudstone. In general, the CPF area exhibits favourable conditions regarding the landslide and erosion hazards. It is also noted that some latent erosion could be encountered outside CPF site.

During operation accidental hydrocarbon or chemical spills or leaks may potentially occur at any area of Project activities within the PAol where these are used or handled. Accidental leaks of reservoir fluids from flowline/trunklines or condensate from the onshore export pipelines may also potentially occur (EIS, 2019).

6.7.4 Mitigation

Table 6-22 describes the relevant mitigation measures and the associated management plans.

Table 6-22: Mitigation measures – Soils and geology

Impact	Mitigation code (As in MP)	Description	Source document
Destabilised landforms causing increased incidence of landslides or mass movements.	EM002	Progressively clear vegetation and rehabilitate cleared areas as soon as practicable to minimise the time cleared areas are exposed; and allow fauna to move away from areas to be cleared, where practicable.	<i>EIS/ Upstream CESMP; 2019</i>
	EM003	Cut trees where practicable to retain the rootstock and maintain soil stability.	<i>EIS/ Upstream CESMP; 2019</i>
	ED008	Use fibre optic cable laid in the same trench to monitor pipelines. This cable will detect intrusions and ground movements	<i>EIS/ Upstream CESMP; 2019</i>
	ED009	Locate valve stations along the onshore pipeline route to isolate pipeline sections if a leak occurs.	<i>EIS/ Upstream CESMP; 2019</i>
	EM029	• Allow forest edges to naturally regenerate or create appropriate conditions to facilitate natural regeneration, e.g. rip the substrate, replace topsoil, apply mulch • Rehabilitate Pandanus habitats, e.g. recreate mounds, re-instate the intertidal surface between Pandanus mounds • Rip compact surfaces across the slope, as appropriate, to facilitate revegetation and minimise erosion. • Spread stockpiled topsoil, organic matter and cleared vegetation over the rehabilitation area to promote natural regeneration. • Use native vegetation to revegetate sites when active rehabilitation measures are required.	<i>EIS/ Upstream CESMP; 2019</i>
	EM006	Areas of higher risk of landslides e.g., steep gradients, previously disturbed land, likely to occur from the works, or likely to be exacerbated by the works, will be stabilised to reduce the landslide risk.	<i>EIS/ Upstream CESMP; 2019</i>
	EM004	Erosion and sediment control measures will be implemented for infrastructure components in accordance with good international industry practice to effectively manage stream and river flows, stormwater, surface erosion, sedimentation and scour, e.g., drainage diversion into surrounding vegetation, rip-rap aprons, rock armoring, energy dissipators, sediment control	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		ponds, mulch berms and sediment fences, where required, until the area has been effectively stabilised and/or rehabilitated.	
	ED013	Project design is based on a risk-management approach, considering geotechnical constraints (e.g., flooding, landslides risks, geohazards) and anticipating and avoiding, or where avoidance is not possible, minimising environmental and social impacts (e.g., avoiding sensitive features, and physical and economic displacement, priority ecosystem services, and minimising the Project footprint, land clearing and disturbance, emissions and discharges).	<i>EIS/ Upstream CESMP; 2019</i>
Degraded soil capacity due to impacts on soil structure and developmental status, fertility or disturbance of soil profiles.	EM001	All sites proposed for development as part of the Project will be subject to a preconstruction survey to clearly identify acid sulphate soils, sensitive sites and habitats, e.g. roosting, breeding, nesting and threatened species sites, priority ecosystem services, archaeological sites, burial sites, sites of religious importance to be subject to specific mitigation measures.	<i>EIS/ Upstream CESMP; 2019</i>
	EM002	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM005	Stabilise spoil stockpiles and areas of ground disturbance as soon as practicable after initial disturbance using, e.g., mulched vegetation, aggregates and soil binders.	<i>EIS/ Upstream CESMP; 2019</i>
	EM006	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM036	Where possible, separate and stockpile cleared topsoil (with the inherent seed bank and any coarse woody debris) to use for future rehabilitation.	<i>EIS/ Upstream CESMP; 2019</i>
Degraded soil capacity due to adverse chemical properties, caused by oxidation of PASS disturbed during earthworks.	EM007	Avoid disturbing acid sulphate soils, potentially in soil Complex 4 coastal soils, and Soil Complex 2 and 3 on alluvial flood plains, beach ridge and plains in the lower Purari River delta, wherever possible, otherwise handle, store, treat, manage and dispose of Acid Sulphate Soils according to good practice guidelines.	<i>EIS/ Upstream CESMP; 2019</i>
Degraded soil capacity due to soil contamination from	EM018	An Emergency Response Plan will be developed to effectively manage the preparedness and response to emergency events. It will contain: Site contingency plans, that will consider fire management measures	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
accidental hydrocarbon or chemical spills or leaks.		An Oil Spill Contingency Plan, that will consider spill risks for construction, operation and decommissioning of facilities and associated infrastructure, and supply services on land and in aquatic and marine environments. A Blow Out Contingency Plan including well blowout control and contingency measures.	
	ED003	Adopt standard industry practices to prevent and protect against soil/water contamination, due to Project activities, such as: - Preparing hydrocarbon and chemical management procedures, as part of the Hazardous Materials Management Plan. - Building infrastructure on impervious surfaces where required. - Providing permanent fuel and chemical stores, and maintenance and refueling areas with secondary containment of an appropriate volume to prevent loss to the environment or mixing with incompatible materials. - Installing interceptor pits or similar to collect contaminated surface water runoff and treat where required. - Installing tanks above ground with impermeable liners and bunds around tanks. - Regularly inspect and maintain the containers, storage and transfer infrastructure to prevent/control spills or leaks. - Installing readily accessible spill kits and training staff in their use. - Appropriately treating and disposing of any accidentally contaminated soils.	<i>EIS/ Upstream CESMP; 2019</i>
	ED005	The landfill will be designed to comply with TotalEnergies's general specification for landfills, and will be designed, located, constructed and operated in general accordance with the intent of the Code of Practice for Sanitary Landfill Sites (DEC, 2001) and other applicable standard industry practices.	<i>EIS/ Upstream CESMP; 2019</i>
	TBC	For Caution Bay shore crossing by HDD, additional mitigation measures have been identified. Specifically, the risk of occurrence of frac outs during HDD will be minimised by:	<i>FEED Changes EAR; 2025</i>

Impact	Mitigation code (As in MP)	Description	Source document
		- Conducting detailed geotechnical investigations to understand ground conditions along bore path to inform assessment of the risk of frac out and avoid paths in weak zones. - Installing casing at the entry point where reduced cover and bearing pressure exists. - Continual monitoring of drilling fluid pressures and losses during drilling and if unexpected variations or trends are observed cease drilling, investigate causes and implement remedial measures.	
Drilling Fluids	ED004	The drilling will be performed using water-based mud.	<i>EIS/ Upstream CESM; 2019P</i>
Storage, use, transport and disposal of hazardous materials.	ED006	Minimise chemical use and select chemicals considering the following criteria: - lowest toxicity, lowest bioaccumulation potential and highest biodegradation; - chemicals subject to bans or phase-outs.	<i>EIS/ Upstream CESMP; 2019</i>
	ED021 ED007	Requirements for hazardous material transfer, overfill protection, and alarms will be implemented, e.g.: - Using dedicated fittings, pipes, and hoses specific to materials in tanks. - Providing secondary containment, drip trays, etc. at connection points or other possible overflow points. - Using dripless hose connections for vehicle tank and fixed connections with storage tanks. - Providing automatic fill shutoff valves on storage tanks to prevent overfilling. - Using piping connections with automatic overfill protection (float valve). - Fitting tanks with high-level alarms with both audible and visible annunciation.	<i>EIS/ Upstream CESMP; 2019</i>
	ED020	Rainwater infiltration into hazardous materials storage areas will be prevented.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
Drainage and Bunding	ED015	The CPF will have an open drain system to manage rainwater; the system will have three separate networks: OD1 = permanently hydrocarbon-contaminated drains. OD2 = accidentally hydrocarbon-contaminated drains. OD3 = hydrocarbon-free drains. Water from each system will be treated separately and discharged to the environment according to applicable limits.	<i>EIS/ Upstream CESMP; 2019</i>

Mitigation strategies focus on the early identification of problematic features—such as PASS and dispersive soils—to inform the EIS and engineering design. The Project must adhere to regulatory standards for a "Level 3 Activity" under PNG's Environment Act 2000. Engineering considerations will be required to address erosion-prone and acidic soil conditions during construction.

For more general soil and sediment management issues, the Project has developed a specific Soil Management Plan (2023), hereafter referred to as Soil MP (2023). The Soil MP (2023) objectives are to:

- Maintain landform integrity and stability.
- Maintain soil quality and capacity.
- Minimise impacts of earthworks on the surrounding environment, including the impacts of sedimentation, run-off and vegetation clearance on water quality, ecological habitat and aesthetic values.

The plan sets out details of management requirements, monitoring and responses to non-compliances.

6.7.5 Residual Impacts

Residual impacts to geology and soil are described in Table 6-23 below. Residual impacts to soil are predominantly Minor after mitigation. These relate mainly to soil structure and fertility degradation from stripping, mixing and compaction during wellpad, borrow pit, road/access track and pipeline ROW earthworks, plus localised contamination risks from fuels/chemicals/hydrocarbons during operations and from accidental spills.

Moderate residual impacts are confined to slope instability (landslide/mass movement) in ridge/ravine landforms and at Elk-2 borrow pit and associated trunklines/roads. Most other soil risks, such as local erosion at specific borrow pits, sandy soil destabilisation, PASS oxidation/disturbance, facility cut-and-fill instability, and HDD-related disturbance at the shore crossing, are assessed as Negligible.

Table 6-23: Summary of potential residual impacts – Soils and geology. (Source (s): EIS (2019); EIS Addendum (2024); and FEED Changes EAR (2025))

Impacting Process	Activity Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual Assessment	
					Sensitivity / Magnitude	Significance
Earthworks (wellpad construction)	Destabilisation of slopes causing localised landslide or mass movement	Ridge and ravine landforms within PRL-15 wellpads (e.g. ELK-10, ANT-10, ANT-11)	C, O	ED013 EM002 EM003 EM006 EM004 EM029	High / Minimal	Minor
	Degradation of soil structure and fertility due to soil stripping, mixing and compaction	Wellpads within PRL-15	C		Medium / Low	Minor
Earthworks (borrow pit, road and access track construction)	Destabilisation causing landslide or mass movement	Elk-2 borrow pit	C, O		High / Low	Moderate
		Roads and access tracks on ridge and ravine landforms within PRL-15	C, O		High / Low	Moderate
	Destabilisation causing local erosion	Borrow pits KP9, KP30, KP54	C, O		Medium / Minimal	Negligible
		Roads and access tracks in PRL-15 (including steep terrain and high rainfall areas)	C		Medium / Low	Minor
	Destabilisation of sandy soils	Borrow pit KP60	C, O		Medium / Minimal	Negligible
Earthworks	Degradation of soil structure and reduction in fertility	Borrow pits and access tracks (all locations)	C	EM001 EM002 EM005 EM006 EM036	Medium / Low	Minor
	Degradation of soil structure and loss of topsoil	CPF P3 site and temporary construction areas	C		Medium / Low	Minor
		Roads and access tracks (all locations)	C		Medium / Low	Minor
	Oxidation of potential acid sulphate soils (PASS)	Borrow pits and access tracks where PASS present (Elk-2, KP9; potential at KP30/54/60)	C	EM007	Medium / Minimal	Negligible
		CPF P3 site alluvial soils	C		Medium / Minimal	Negligible
		Wellpads intersecting soil complexes 2 and 3 (localised)	C		Medium / Minimal	Negligible
		Trunklines intersecting Soil Complexes 2, 3 and coastal soils	C		Medium / Minimal	Negligible

Impacting Process	Activity Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual Assessment	
					Sensitivity / Magnitude	Significance
Earthworks (facility construction and cut-and-fill)	Localised landform modification and instability	CPF P3 site	C, O	EM004	Medium / Minimal	Negligible
Trenching and earthworks	Destabilisation causing landslide or mass movement	Trunklines on ridge and ravine landforms within PRL-15	C, O	EM002 EM003 EM004 EM006 EM029	High / Low	Moderate
	Degradation of soil structure and fertility	Trunkline ROW through PRL-15	C	EM001 EM002	Medium / Low	Minor
		Onshore export pipeline ROW	C	EM005 EM006 EM036	Medium / Low	Minor
	Increased erosion and sediment generation	Trunkline ROW, including watercourse crossings	C	EM004 EM005 EM006		
		Onshore export pipeline ROW	C	EM004	Medium / Minimal	Negligible
Trenching	Disturbance of potential acid sulphate soils (PASS)	Export pipeline alluvial and littoral sections	C	EM007	Medium / Minimal	Negligible
Facility operations	Soil contamination from fuels, chemicals or hydrocarbons	CPF P3 site	C, O,D	EM018 ED003	Medium / Low	Minor
		Wellpads		ED005 ED006	Medium / Low	Minor
Earthworks and operations	Accidental hydrocarbon or chemical spills	PRL-15 and Export Pipeline Corridor		ED009 ED020	Medium / Low	Minor
		Roads and access tracks (PRL-15)		ED021	Medium / Low	Minor
Operations	Localised soil contamination from leaks or small accidental releases	Trunklines within PRL-15	O, D	EM018 ED003 ED005 ED006 ED007 ED008	Medium / Low	Minor
Operations (road use and maintenance)	Ongoing erosion and soil compaction	Roads and access tracks (PRL-15)	O	EM004 EM006	Medium / Minimal	Minor
Trenchless construction (HDD)	Ground disturbance and loss of drilling fluids	Caution Bay shore crossing	C	ED004	Medium / Minimal	Negligible

6.7.6 Unplanned and Non-Routine Events: Soils and Geology

Section 6.7.6 presents a synthesis of Project documentation relating to unplanned and non-routine events that could potentially impact geology and soils.

Construction and Operations Phase

The following causes of unplanned events due to the characteristics of soils and geological features of the study area are considered below:

- Seismic hazards and Tsunamis
- Floods
- Soil instability

Seismic Hazards and Tsunami

The upstream terrestrial Project area from PRL-15 to the coast at Orokolo Bay is located in Seismic Zone 3 based on the zoning provided by the PNG building standards Papua New Guinea National Seismic Code (DOWS, 1982). This zone is a moderate seismic hazard zone for building construction in PNG. The offshore export pipeline corridor through the Gulf of Papua to Caution Bay is in Seismic Zone 4, which is a low seismic hazard zone.

Recent structural and geohazard investigations indicate several active faults in the Project area, presenting moderate to high geohazard risks.

There are no volcanoes in the study area. The closest active volcanoes are Crater Mountain and Yelia, which are located 65km north and 85km east of PRL-15, respectively.

The whole of the Gulf of Papua, where the offshore export pipeline corridor is located, is in the lowest tsunami hazard zone, Zone 3, which is considered to experience a low frequency of tsunamis (DOWS, 1982). This low level of concern reflects the fact that no active submarine tectonic trenches or volcanoes exist in the region.

Major seismic events have the potential to cause damage and failure of project infrastructure creating the potential for secondary effects due to loss of containment of hazardous materials, injury and fatality of project personnel.

Soil Instability

During construction the mismanagement of stockpiles, unvegetated slopes and excavations could result in soil instability and collapse, causing damage to infrastructure and potential injury and fatality of personnel.

Decommissioning / Closure Phase

Risks due to seismic hazards, tsunami and soil instability during decommissioning will be similar to the risk during construction and operations.

Mitigations

The following mitigation measures have been identified that will reduce the severity of unplanned events due to soil and geological conditions these are detailed in Section 6.7.4

- Facility design and construction standards
- Early warning of seismic activity and tsunami
- Preservation of mangroves
- Risk assessment to determine hazardous conditions (e.g. heavy rainfall)

- Emergency response

Residual Impacts

The risk of significant impacts due to geological hazards has low probability but is potentially high consequence. The severity of the potential impacts will be mitigated by the design and management measures described above and further detailed in Section 6.1.

6.8 Hydrology, Hydrogeology, and Water Resources

6.8.1 Introduction

This section presents a synthesis of Project documentation relating to hydrology and hydrogeology. Assessments of Project impacts on hydrology and hydrogeology have been undertaken within the EIS (2019), EIS Addendum (2024), D&B ESIA (2025), and FEED Changes EAR (2025). The baseline, impact assessment, mitigation measures and residual impacts are presented initially for hydrology, and then latterly for hydrogeology.

6.8.2 Hydrology Baseline

The Project Site lies within the lower catchment of the Purari River, PNG's third largest river by catchment size. The CPF and pipelines will be located in the lower part of the catchment, where the river is a wide, meandering channel cut into sedimentary coastal plains. The river is subject to substantial scour on the outside of bends, forming a deeper channel, with shallow sand and mud banks deposited on the inside of river bends. A semi-continuous channel > 7 m deep extends along the Purari River from the river mouth (eastern channel) to Herd Base.

Downstream of PRL-15 within the delta, the Purari River splits into the three main distributary channels: the Purari River channel, Urika-Ivo River channel and the Wame-Varoi channel. All flow into the Gulf of Papua.

The Purari River lower catchment consists of a large floodplain and is prone to flooding. High rainfall occurs throughout the year, and flood events can occur in any month. However, there are seasonal differences in rainfall and associated flow patterns.

Pickup and Chewings (1983) calculated the mean daily discharge from the Purari River to be 2,360 m³/s, with a maximum up to 10,405 m³/s and average annual minimum of 1,920 m³/s. The Purari River has characteristically low interannual flow variability. However, at daily timescales river levels can rapidly change in response to rainfall. River level measurements of the Purari River at Herd Base show rapid changes in water levels in the order of meters associated with changing flow events. HR Wallingford (2023) reports changes in the flow rate of approximately 1,000 m³/s over several days, equivalent to changes in water level in the river of 1 to 2 m. These fluctuations occur throughout the year and do not follow a particular seasonal pattern.

The surface water and sediment quality of streams in PRL-15 was investigated with sampling and analysis undertaken in June/July 2016 (northwest monsoon season) and in January/February 2017 (southeast trade wind season) as part of broader baseline investigations (EIS Vol. 2 Part 03 Upstream Surface Water & Sediment Quality Baseline, 2017, hereafter EIS Surface Water & Sediment Quality Baseline, 2017). The study area included a sampling site in the Purari River near Hou Creek.

Additional sampling of water and sediment in the Purari River was undertaken in 2023 for the D&B ESIA (2025) and subsequent project assessments. This included sampling at four locations in the area proposed for aggregate extraction near Hou Creek. Three field surveys were undertaken to supplement existing information on marine and upstream hydrodynamics, sediment and water quality, aquatic species, benthic ecology and marine fauna presence.

The Project area as described in the EIS (2019) includes a range of high-, moderate- and low-gradient tributary streams and the main Purari River. The Purari River consists of both freshwater and estuarine components, with the estuarine boundary delineated by the inland extent of mangrove vegetation. In describing the study area, a distinction is made between freshwater and estuarine areas, as follows:

- All waterways and waterbodies in PRL-15 are considered to be freshwater.
- All waterways and waterbodies upstream of the indicative mangrove line mapped by Shearman (2010) are considered to be freshwater while all waterways and waterbodies downstream of this line, which is approximately 10km from the coast, are estuarine.

The tributary streams of the Purari River in PRL-15 are characterised by low electrical conductivity with minimal seasonal variability. These streams are slightly to moderately alkaline and contain high bicarbonate levels. Turbidity levels in these streams are generally lower than the main channel of the Purari River but increase near the confluences with the river. The Purari River has elevated turbidity and suspended sediment levels year-round; although, these reach a peak during the northwest monsoon (December to March) when river flow is highest due to higher rainfall in the upper catchment. Freshwater flows heavily dominate the river, with an underlying saltwater wedge present near the river mouth.

River Water and Sediment Quality

As described in the EIS (2019), the Purari River has low levels of nutrients and metals and no evidence of contamination by petroleum hydrocarbons or other organic contaminants. However, microbiological quality is poor with coliform bacteria present at levels exceeding drinking water standards and it has elevated levels of suspended sediments and turbidity (with turbidity levels of up to 1,000 NTU (Nephelometric Turbidity Unit) recorded following rainfall events). Baseline characterisation showed no sediment contamination in the Purari River, or in other streams in PRL-15, by metals, petroleum hydrocarbons or other organic contaminants.

Characterisation of water and sediment quality has been undertaken at various zones of the Purari River, including the Purari River mouth, lower Purari, mid-Purari and upper Purari, during 2023 as part of studies for a D&B ESIA (2025).

Nutrient concentrations were broadly comparable across all sites and present in negligible amounts. Inorganic and organic carbon content was also low.

Concentrations of metals and metalloids were below international sediment quality guidelines levels (ANZG, 2018), except for nickel, consistent with results reported in the EIS (2019) and D&B ESIA (2025). The exceedance for nickel is attributed to naturally elevated levels of nickel occurring in sediment associated with the regional geology.

Further water quality, sediment and soil sampling and analysis were conducted in June 2023 to inform the D&B ESIA (2025) which determined that, with one exception, dissolved concentrations of most metals/metalloids were below the ANZG (2018) guideline values (DGVs) and PNG ER guidelines in all water samples. The exception was copper in a single sample (M45 MID (1.5µg/L), which was slightly higher than the ANZG (2018) 95% species protection DGV of 1.3µg/L.

River sediment sampling indicated the presence of PASS in sediment at all dredging work areas, with net acidity - minus acid neutralising capacity (ANC) - exceeding the action criterion. This is consistent with geology soil samples and indicates the requirement for further investigation and PASS management, as necessary. Measurements of ANC indicate that the sediment has sufficient carbonate content to neutralise any acidity generated if material is oxidised (e.g., if brought on-land); however, incubation tests are required to confirm neutralisation effectiveness. Such incubation tests have been undertaken on some of the collected samples (from Purivo junction) which confirmed that the ANC was effective in neutralising the acid generated upon oxidation.

Purari River Hydrodynamic Modelling

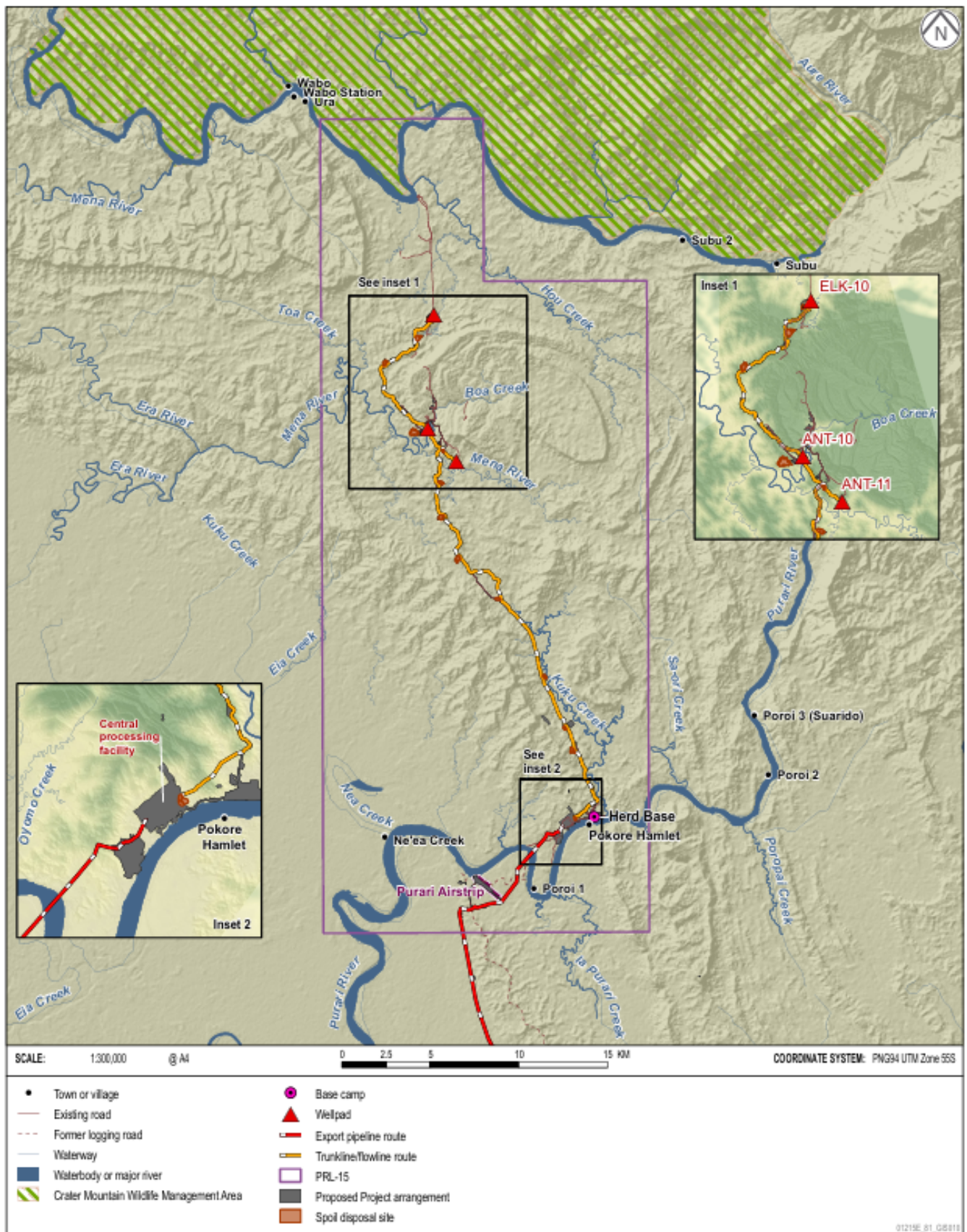
As per the D&B ESIA (2025), modelling was undertaken using TUFLOW to create a three dimensional (3D) hydrodynamic and sediment transport model for the Purari River to resolve the vertically stratified 'salt

wedge' regime that occurs in the downstream Purari River. Eleven model simulations were developed with dredging cases at various dredging locations along the Purari River including early work sites. The dredging impact assessment sites were run over hindcast periods corresponding to the length of the dredging campaigns, and the base and developed case scenarios were run over a year-long period to capture periods of high and low flow river conditions.

Additionally, a vessel wake assessment was completed on a total of 34 locations within the Purari River that were identified in a previous report to be high risk locations for bank erosion from vessel traffic. Four vessels identified in previous reports (two self-propelled LCTs (GFS Marine 05 and 01) dumb barge, and smaller ferry boat) were tested under predictive formulas for vessel wake waves (primary and secondary) using a range of vessel velocities from 3 to 10 knots with a 1-knot increment.

Project Watercourse Crossings

The gas and condensate gathering and pipeline network with shared road access where possible, will result in multiple watercourse crossings, which are illustrated in Figure 6-7 below. The PER south (gas and condensate) will cross the Purari River south of the CPF (Figure 6-7). Further design and geophysical investigations are being undertaken by TEP PNG to confirm the suitability of the proposed river crossing location and engineering requirements to allow a trenchless approach.



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Figure 6-7: Watercourse pipeline crossings (Source: EIS Addendum, 2024) Note: The Project footprint has undergone changes since 2024 and no longer includes Quarry C/D or activities at Boa Creek.

Floods

Pickup and Chewings (1983) present a flood frequency curve for the Purari and the Aure rivers, from which the following observations regarding flow events are made:

- Flood variability for both rivers across years is low, due in part to the regularity and length of the wet season, which ensures saturation remains high throughout the year and across years.
- While floods can occur throughout the year in both rivers, flood events in the Purari River at Wabo are generally linked to southeasterly weather patterns that occur from June to September. By contrast, flooding in the Aure River appears to be dominated by north-westerly patterns in February to March.
- Low flow events can occur at any time of the year but are more directly correlated to seasons than to flooding. For both rivers, the lowest flow events in the upper Purari River catchment and in the Aure River catchment tend to occur during the southeasterly season. This is also the season when floods occur on the Purari River downstream of Hathor Gorge. The difference is attributable to the reverse seasonality experienced in the lower part of the catchment compared to the upper catchment.

No information is available regarding flooding and low flow events in the Pie and Era River catchments, but these are expected to strongly correlate to the Purari River downstream of Hathor Gorge. To further understand flood behaviour in the study area, TUFLOW hydraulic modelling of 20 sub-catchments was undertaken for 10-, 50- and 100-year. Average Recurrence Interval (ARI) events the modelling identified two types of channels/floodplains in the study area:

- Well-defined channels/floodplains with a single main channel within the flood extent, mainly found in smaller tributaries of the upper Era and Purari River catchments in PRL-15.
- The Purari River from Herd Base to the PRL-15 oxbow wetlands also has these characteristics. Poorly defined channels/floodplains with multiple intermingling channels across a wide floodplain, mainly found in the tributaries flowing to the Purari River delta and the PRL-15 oxbow wetlands.

For sub-catchments with well-defined channels, flood extents tend to be similar for each ARI event as floodwaters are constrained by the channel limits. Flood velocities range from 2.2 to 7.8 m/s. In contrast, flood extents are larger for poorly defined channels/floodplains, but flood velocities tend to be lower, from 1.8 to 3.5 m/s. As per the EIS Existing Environment – Terrestrial (2019) stream velocity does not change greatly between 10-, 50- and 100-year ARI events for either type of channels.

Major flood events have the potential to damage construction and operational facilities, cause interruptions of construction and operational activities and generate secondary effects including health and safety risks and loss of containment of hazardous materials.

6.8.3 Hydrology Impact Assessment

Project documentation identifies the following potential impacts on hydrology as a result of Project activities:

- Impacts to stream flow
- Impacts to surface water quality
- Changes to hydraulic processes
- Impacts from dredging.

Impacts to Stream Flow

The EIS (2019) identified that water will be required for the following Project activities, which could have an impact on stream flow:

- Creation of drilling mud for production drilling

- Pressurizing of drilling mud for well control purposes
- Pipeline cleaning and hydrotesting
- Processing of reservoir fluids and gas at the CPF
- Potable water supply for the CPF, Logistics Base and accommodation camps.

Approximately 200 m³/day of water will be required at each well to create drilling muds, with occasional peaks of up to 1,300 m³/day. Water is also needed to pressurise the drilling mud for well control purposes, and a flow rate of 100 m³/day will be required. The total water demand during drilling is expected to be between 300 and 1,400 m³/day at each well.

Water for the ANT-10 and ELK-10 drilling and wellpads is expected to be extracted from Boa Creek and Hou Creek, respectively. So that enough water is available during periods of low river flow, temporary dam structures 5-m high will be constructed on the creeks, which will create a water storage volume of 2,000 m³.

Water to clean and hydrotest the onshore pipelines is expected to be drawn from the Purari River at the Logistics Base. The volume of water required will be defined during FEED; however, it can be expected to be approximately equivalent to the total volume of the onshore pipelines, i.e., approximately 19,000 m³ for flowlines and trunkline and 50,000 m³ for export pipelines. The total volume of water required for hydrotesting is therefore estimated to be approximately 69,000 m³; however, water extraction requirements will be less than this volume since hydrotest water will be recycled from one section of pipe to another.

The average minimum flow rate of the Purari River measured at Wabo is 1,920 m³/s, which is equivalent to 165,000,000 m³/day. At the extraction point at the Logistics Base, the flow rate is greater due to the additional inflows from the Aure River. The total water extraction requirements for hydrotesting (69,000 m³); therefore, represents less than 0.05% of the total daily flow under minimum flow conditions.

Approximately 2,500 m³/day of water will also be extracted from the Purari River for use at the CPF; 100 m³/day is required for domestic water supply for the accommodation camp. This volume represents less than 0.002% of the average minimum flow of the Purari River.

Impacts to Surface Water Quality

The EIS (2019) describes the following potential Project-related impacts to surface water quality:

- Contamination from planned wastewater discharges, including:
 - o Hydrotest Water
 - o Sewage effluent
 - o Contaminated stormwater
- Contamination caused by discharging firefighting foams during training and testing.
- Contamination caused by accidental hydrocarbon or chemical release.

The consideration of spills or leaks is related to releases that are accidental (but controllable), as part of construction, operation and decommissioning of large projects. For Major Hazards refer to Section 6.1.

Impacts to water quality from contaminants potentially mobilised by dredging have been assessed and are considered negligible by the D&B ESIA, reflecting the low contaminant concentrations in dredged sediments. Likewise, the potential for contaminants to accumulate in sediments as a result of planned or accidental discharges over time is considered negligible.

Vessel movements were identified as having potential impacts on water quality, it is noted that small-powered craft generate the greatest wake due to their speed, while slower vessels like dredgers are unlikely to cause large water disturbance or sediment plumes.

Changes to Hydraulic Processes

The EIS (2019) identifies the following Project activities as potentially affecting hydraulic processes:

- Diversion of overland flows (and associated operation of stormwater infrastructure) and defined stream channels.
- Vegetation clearance.
- Installation of pipelines across waterways.
- Installation of culverts to maintain flows.

Diversion of Overland Flows

Overland flows (i.e., outside defined channels) will be diverted around Project infrastructure (including new quarries). This could cause highly localised changes to overland drainage patterns in and adjacent to the disturbance footprint; however, defined waterways will typically be retained in their present form and will not be diverted.

Vegetation Clearance

Vegetation clearing and earthworks will increase the volume of runoff by replacing previously vegetated areas with surfaces with an increased runoff potential (e.g., roads and grassed areas). Increased runoff can cause localised scour, especially where runoff is channelled through drainage networks to a single discharge point.

Installation of Pipelines Across Waterways

The crossing of the Purari River will use a trenchless method beneath the river and therefore has no implications for earthworks or surface level changes. According to the EIS Addendum (2024), potential impacts to hydraulic processes and sediment transport relating to the CPF (P3) location include:

- Alteration of hydrology or flow characteristics due to diversion or filling of defined waterways in the CPF footprint.
- Soil erosion due to ground disturbance causing increased Total Suspended Solids (TSS), turbidity and sedimentation of defined waterways in the CPF footprint.

There is a need for minor re-routing of the flowline to, and export pipeline from, the CPF site location along the selected route. These minor changes are not regarded to materially alter the impact assessments described in the EIS (2019).

Installation of culverts to maintain flow

Culverts will be installed to maintain flows; however, inappropriately designed culverts can interfere with stream flows and associated morphological processes. Upstream flooding can occur during high flow events when the culvert flow capacity is exceeded causing scour.

Impacts from Dredging

The D&B ESIA (2025) describes numerical modelling of construction and navigation dredging activities in the Mid and Lower Purari River focusing on the generation of turbid plumes and changes in hydrodynamics based on the dredge production rates and estimated dredge volumes. Modelling predicted some persistent increases in local turbidity and short-term spikes in turbidity (represented by the 50th percentile of the dredging-related turbidity).

Construction dredging is currently proposed at four locations and navigation dredging currently proposed at seven locations. Where navigation dredging involves the creation of channels through areas that are

presently shallow during low-flow conditions, there is potential for local and upstream/downstream changes in hydrodynamics and riverbed morphology. However, in each case the net effect of dredging will be to concentrate flow in the deepened part of the channel and reduce the flow rate and water velocity outside the channel. Since there will be no change in the overall flow rate in the river, the net overall effect on river hydrodynamics is minor.

Overall, due to general high ambient TSS and the high natural variability TSS, it is not expected that dredging will have any detrimental impacts to water quality in the receiving environment. Dredging for navigation purposes may cause minor upstream/downstream hydrodynamic changes but are not expected to change the overall flow rate of the river. Placement activities may cause localised changes to the immediate riverbed morphology but would have negligible effects to the overall geomorphology of the river.

In terms of cumulative impacts, the sediment potentially released from dredging will be minimal comparative to the natural sediment loads travelling through the Purari River. Actual water quality changes are negligible comparative to background, so even with continuous dredging over a multi- year period, it is unlikely that there will be a cumulative impact that would exceed that of any single dredging location.

The Hou Creek Aggregate Dredging EAR (2025) builds on the hydrology and surface water assessments presented in the D&B ESIA (2025) and EIS (2019), supplemented by Hou Creek-specific hydraulic and water quality assessments. It draws on the earlier dredging and barging studies plus Hou Creek specific hydraulic and TSS modelling to show that changes in flow, geomorphology and sediment transport are small, localised around the extraction areas and within natural hydrological variability.

For surface water quality, the Hou Creek Aggregate Dredging EAR (2025) follows the assessment approach used in the D&B ESIA (2025) and concludes that dredging related increases in TSS and turbidity at Hou Creek are short-term, spatially limited and quickly attenuate downstream, consistent with patterns already described for main Purari dredging and barging activities. The EAR also draws on the D&B ESIA (2025) where effects have previously been demonstrated to be negligible (for example, vessel wake, small volume water abstraction and compliant sewage treatment plant discharges).

6.8.4 Hydrology Mitigation

A range of mitigation measures have been identified to manage impacts to hydrology, as identified within the Project documentation Table 6-24 below describes these mitigation and management measures.

Table 6-24: Mitigation measures - Hydrology, fluvial geomorphology and sediment processes

Impact	Mitigation code (As in MP)	Description	Source document
Alterations to hydrology, flow characteristics and scouring (due to earthworks and physical infrastructure)	EM009	Backfill trenches as soon as practicable after disturbance, using material originally excavated from the trench as much as possible. The backfilled trenches should not exceed the preconstruction levels after the material has settled.	<i>EIS/ Upstream CESMP; 2019</i>
	EM010	Minimise or avoid sidecasting during construction (e.g., for road, pipeline, wellpad and CPF works). Any sidecasting that does occur will avoid defined stream channels.	<i>EIS/ Upstream CESMP; 2019</i>
	EM004	Erosion and sediment control measures will be implemented for infrastructure components in accordance with good international industry practice to effectively manage stream and river flows, stormwater, surface erosion, sedimentation and scour, e.g., drainage diversion into surrounding vegetation, rip-rap aprons, rock armoring, energy dissipaters, sediment control ponds, mulch berms and sediment fences, where required, until the area has been effectively stabilised and/or rehabilitated.	<i>EIS/ Upstream CESMP; 2019</i>
	EM011	Water from trenches will be discharged in accordance with applicable water quality standards with erosion and sediment controls where relevant.	<i>EIS/ Upstream CESMP; 2019</i>
	EM020	Maintain hydraulic and biological connectivity during construction and operations in natural flow lines across linear infrastructure, such as pipelines and roads, and in relation to water extraction, e.g. dams, including: • Install appropriately sized culverts, drains and structures to allow fish passage, according to good international industry practice standards. • Rehabilitate waterways after construction and decommissioning to a sustainable, stable state, that reflects the original character, and maintains waterway flows and connectivity.	<i>EIS/ Upstream CESMP; 2019</i>
Deterioration of surface water quality, alterations to flow, and increased erosion	ED012	Hydrotesting will be undertaken to confirm weld integrity	<i>EIS/ Upstream CESMP; 2019</i>
	EM015	Hydrotest water management will consider: • The definition of volume and discharge rates and discharge locations.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
and sedimentation due to hydrotesting		- Chemicals additives selection, according to requirements defined in embedded design controls. - Reusing hydrotest water to minimise the discharge volume. - Reducing the need for chemicals by minimising the time hydrotest water remains in the pipeline. - Monitoring hydrotest water discharges to the environment against applicable limits.	
	EM020	See above	<i>EIS/ Upstream CESMP; 2019</i>
	ED040	Hydrotest water discharges will be managed according to applicable requirements.	<i>EIS/ Upstream CESMP; 2019</i>
Soil erosion causing increased TSS, turbidity and sedimentation of streams (due to earthworks and physical infrastructure)	EM002	Progressively clear vegetation and rehabilitate cleared areas as soon as practicable to minimise the time cleared areas are exposed; and allow fauna to move away from areas to be cleared, where practicable.	<i>EIS/ Upstream CESMP; 2019</i>
	EM003	Cut trees where practicable to retain the rootstock and maintain soil stability.	<i>EIS/ Upstream CESMP; 2019</i>
	EM004	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM005	Stabilise spoil stockpiles and areas of ground disturbance as soon as practicable after initial disturbance using, e.g., mulched vegetation, aggregates and soil binders.	<i>EIS/ Upstream CESMP; 2019</i>
	EM010	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM011	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM012	Maintain buffer zones between permanent surface water and project infrastructure, except to carry out works associated with the construction of watercourse crossing or where facilities are proposed to be located within that buffer.	<i>EIS/ Upstream CESMP; 2019</i>
	EM006	Areas of higher risk of landslides e.g., steep gradients, previously disturbed land, likely to occur from the works, or likely to be exacerbated by the works, will be stabilised to reduce the landslide risk.	<i>Project Raw Materials Management Procedure; 2026</i>

Impact	Mitigation code (As in MP)	Description	Source document
	EM006	Areas of higher risk of landslides e.g., steep gradients, previously disturbed land, likely to occur from the works, or likely to be exacerbated by the works, will be stabilized to reduce the landslide risk.	<i>Project Raw Materials Management Procedure; 2026</i>
	EM013	Minimise in-stream and stream bank disturbance during high rainfall.	<i>EIS/ Upstream CESMP; 2019</i>
Deterioration of surface water quality/ erosion and increased sedimentation due to vessel operation	ED022	Ballast waters, liquid effluents and waste from vessels will be managed in accordance with the MARPOL 73/78 requirements.	<i>EIS/ Upstream CESMP; 2019</i>
	EM014	Implement low speed limits through areas sensitive to vessel wash impacts.	<i>EIS/ Upstream CESMP; 2019</i>
	EM019	Vessels will be required to have shipboard Oil Pollution Emergency Plans/Oil Spill Contingency Plans as per TotalEnergies' requirements and Marine Pollution (Ships and Installations) Act 2013.	<i>EIS/ Upstream CESMP; 2019</i>
Deterioration of surface water quality due to discharges or accidental releases	EM008	Sewage effluents from Project facilities will be treated to meet the environment (waste discharge) permit before discharge, in accordance with applicable standards.	<i>EIS/ Upstream CESMP; 2019</i>
	EM016	Training and test releases of firefighting foams at the CPF are to be contained within appropriate drainage water treatment networks	<i>EIS/ Upstream CESMP; 2019</i>
	EM017	Vehicle wash down and fuel handling will be undertaken considering possible receptors e.g., streams, Purari River and the marine environment	<i>EIS/ Upstream CESMP; 2019</i>
	EM018	An Emergency Response Plan will be developed to effectively manage the preparedness and response to emergency events. It will contain: • Site contingency plans, that will consider fire management measures. • An Oil Spill Contingency Plan, that will consider spill risks for construction, operation and decommissioning of facilities and associated infrastructure, and supply services on land and in aquatic and marine environments. • A Blow Out Contingency Plan including well blowout control and contingency measures.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
	ED003	Adopt standard industry practices to prevent and protect against soil/water contamination, due to Project activities, such as: • Preparing hydrocarbon and chemical management procedures, as part of the Hazardous Materials Management Plan. Building infrastructure on impervious surfaces where required. • Providing permanent fuel and chemical stores, and maintenance and refueling areas with secondary containment of an appropriate volume to prevent loss to the environment or mixing with incompatible materials. • Installing interceptor pits or similar to collect contaminated surface water runoff and treat where required. • Installing tanks above ground with impermeable liners and bunds around tanks. • Regularly inspect and maintain the containers, storage and transfer infrastructure to prevent/control spills or leaks. • Installing readily accessible spill kits and training staff in their use. • Appropriately treating and disposing of any accidentally contaminated soils.	<i>EIS/ Upstream CESMP; 2019</i>
	ED006	Minimise chemical use and select chemicals considering the following criteria: • lowest toxicity, lowest bioaccumulation potential and highest biodegradation; • chemicals subject to bans or phase-outs.	<i>EIS/ Upstream CESMP; 2019</i>
	ED020	Rainwater infiltration into hazardous materials storage areas will be prevented.	<i>EIS/ Upstream CESMP; 2019</i>
	ED021	Requirements for hazardous material transfer, overfill protection, and alarms will be implemented, e.g.: • Using dedicated fittings, pipes, and hoses specific to materials in tanks. • Providing secondary containment, drip trays, etc. at connection points or other possible overflow points.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		- Using dripless hose connections for vehicle tank and fixed connections with storage tanks. - Providing automatic fill shutoff valves on storage tanks to prevent overfilling. - Using piping connections with automatic overfill protection (float valve). - Fitting tanks with high-level alarms with both audible and visible annunciation.	
	ED014	All facilities and infrastructure will be constructed with surface-water drainage systems to reduce the potential for soil loss and degradation both on and off construction areas, and to limit soil erosion and discharge of sediment-laden water to local drainage lines and watercourses. Bridges and culverts will be designed to allow for high flow events following heavy rainfall and to replicate natural flow characteristics as far as practicable. The design is: - To account for local rainfall conditions and catchment size of works areas. - To allow avoiding unseasonal waterlogging. - To allow for rainfall events with an annual reoccurrence interval (ARI) of at least two years for temporary roads and up to 20 to 50 years for long-term major haulage routes as far as practicable.	<i>EIS/ Upstream CESMP; 2019</i>
	ED015	The CPF will have an open drain system to manage rainwater; the system will have three separate networks: OD1 = permanently hydrocarbon-contaminated drains. OD2 = accidentally hydrocarbon-contaminated drains. OD3 = hydrocarbon-free drains. Water from each system will be treated separately and discharged to the environment according to applicable limits.	<i>EIS/ Upstream CESMP; 2019</i>
	ED016	All OD1 waters will undergo water treatment by a hydrocarbon/water separation system prior to discharge to the Purari River according to applicable standards. All OD2 waters and water from primary treatment will be sent to an observation basin and treated by the hydrocarbon/water separation system prior to release if required. The clean OD2 water will be discharged to the Purari	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		River. Non-contaminated stormwater (OD3) will be disposed of by natural percolation and evaporation	
	ED017	All OD1 water from wellpads will be collected in a dedicated closed tank and transported to the CPF for treatment prior to being discharged	<i>EIS/ Upstream CESMP; 2019</i>
	ED018	The produced water generated at the CPF will be injected back into the reservoir. Produced water will be retained in a tank with a capacity to contain five days of water production, as a backup if injection is unavailable.	<i>EIS/ Upstream CESMP; 2019</i>

Further design of drainage, waterway crossings and infrastructure alignments will be undertaken during the detailed design phase of the Project. These design activities will provide an inherent level of mitigation or avoidance of impacts.

6.8.5 Hydrology Residual Impact Assessment

Residual hydrology impacts after mitigation are assessed as predominantly Negligible to Minor, reflecting that most Project-related changes to surface water systems are localised, short-term, and effectively managed. Construction activities such as earthworks, watercourse crossings, dredging, and vessel movements may still cause temporary increases in turbidity, localised sedimentation, and minor changes in hydraulic processes, but these are reduced through erosion controls, progressive rehabilitation, and low-impact river-crossing methods.

Activities along the Purari River and at Hou Creek associated with aggregate dredging, and the potential for accidental hydrocarbon spills, retain Moderate residual impacts, particularly related to water quality deterioration and geomorphological disturbance, although these remain spatially limited and manageable. Potential soil erosion due to ground disturbance at CPF P3 site, causing increased TSS, turbidity and sedimentation of defined waterways, also retains a Moderate residual impact.

Residual impacts to hydrology are described in full in Table 6-25.

Table 6-25: Summary of potential residual impacts - Hydrology

Impacting Process	Activity	Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual Impact Assessment	
						Sensitivity / Magnitude	Significance
Contamination of surface water quality	Disposal of pipeline hydrotest water	Deterioration in the Purari River water quality.	PRL-15	C	EM008 EM011	Medium/Minimal	Negligible
	Sewage effluent discharge		PRL-15	C, O	EM015 ED022	Medium/Minimal	Negligible
	Treated stormwater discharge		PRL-15	O	ED040	Medium/Minimal	Negligible
	Firefighting foam discharge during fire response training and equipment testing		PRL-15	O	EM016	Medium/Low	Minor
	Use of hazardous materials	Deterioration in water quality of the PAol waterways.	PRL-15 onshore pipeline routes	C, O	EM017 EM018	Medium/Low	Minor
		Deterioration in the Purari River water quality.	River transport corridor	C, O	EM019	Medium/Minimal	Moderate
	Treated stormwater discharge	Deterioration in Purari River water quality	CPF P3 Site	O	EM008 EM016	Medium/Minimal	Negligible
	Sewage effluent discharge			C, O, D		Medium/Minimal	Negligible
	Discharge of firefighting foams			O		Medium/Low	Minor
	Accidental hydrocarbon or chemical releases	Deterioration in stream water quality	Purari River CMWMA	C, O, D	EM017 EM018	Medium/Low	Minor
	Accidental hydrocarbon or chemical releases (Aggregate dredging in the Purari River and Hou Creek)	Deterioration in Purari River water quality		C, O, D		Medium/Medium	Moderate
	Changes to hydraulic processes and sediment transport Changes to hydraulic	Earthworks and physical infrastructure	Scour of waterways at pipeline crossings.	Onshore pipeline routes	O	EM004 EM009	Medium/Minimal
Change in drainage patterns at waterway road crossings.			Onshore pipeline routes	O	Medium/Minimal		Negligible
Soil erosion due to ground disturbance causing increased TSS,			PRL-15	O	Medium/Minimal		Moderate

Impacting Process	Activity	Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual Impact Assessment	
						Sensitivity / Magnitude	Significance
processes and sediment transport		turbidity and sedimentation of the Mena River, Kuku Creek and Boa Creek					
		Soil erosion due to ground disturbance causing increased TSS, turbidity and sedimentation of the Era River and Hou Creek	PRL-15	O		Medium/Minimal	Negligible
		Soil erosion due to ground disturbance causing increased TSS, turbidity and sedimentation of the Purari River and adjoining subcatchments downstream of the export pipeline crossing	PRL-15 Onshore pipeline route	O		Low/Low	Minor
		Soil erosion from roads causing increased TSS, turbidity and sedimentation of Boa Creek, Mena River, and Kuku Creek	PRL-15	C,O		Medium/Low	Minor
		Soil erosion from roads causing increased TSS, turbidity and sedimentation of Hou Creek and Era River	PRL-15	C,O		Medium/Minimal	Negligible
		Soil erosion from roads causing increased TSS, turbidity and sedimentation of the Purari River and adjoining subcatchments downstream of the export pipeline crossing.	PRL-15 Export pipeline route	C,O		Medium/Low	Minor
		Alteration of hydrology or flow characteristics due to filling and diversion of defined waterways	Vicinity of CPF P3 Site	C	EM004	Medium/Low	Minor
		Soil erosion due to ground disturbance causing increased TSS, turbidity and sedimentation of defined waterways	CPF P3 site	C	EM002 EM003	Medium/Medium	Moderate
				D	EM004 EM005	Medium/Low	Minor

Impacting Process	Activity	Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual Impact Assessment	
						Sensitivity / Magnitude	Significance
		Soil erosion due to ground disturbance causing increased TSS, turbidity and sedimentation of Purari River	CPF P3 site	C, D	EM006 EM010 EM011 EM012 EM013	Low/Low	Minor
	Discharge of wastewater, stormwater and hydrotest water	Scour at point source discharge locations	River transport corridor	C,O		Medium/Minimal	Negligible
	Dredging at the Logistics Base	Changes in fluvial geomorphology of the Purari River.	River transport corridor	C,O	EM037	Low/Low	Minor
		Increased TSS or turbidity in Purari River	River transport corridor	C,O		Low/Minimal	Negligible
	Logistics and transport (barging along the waterways)	Scour of high-risk areas, with consequent sediment mobilisation.	River transport corridor	C,O	EM014	Low/Minimal	Negligible
	Aggregate dredging in the Purari River	Alterations to hydrology, flow characteristics and scouring (due to aggregate dredging)	Purari River	C, O, D		Low/Low	Minor
			CMWMA	C, O, D		Low/Minimal	Negligible
Reduction in stream flow	Water extraction	Reduced flows in Hou and Boa creeks (due to water extraction for drilling).	PRL-15	C,O	EM015 EM020	Medium/Low	Minor
		Reduced flows in the Purari River (due to water extraction for the CPF, hydrotesting and potable water supply).	PRL-15	C,O		Low/Minimal	Negligible

Notes: C = construction, O = operations, D = decommissioning

6.8.6 Hydrogeology Baseline

As described in the EIS (2019), the fieldwork component of the groundwater survey [to inform the 2017 baseline and subsequent studies] was undertaken in November 2016, for the upstream area, consisting of sites within PRL-15 and the onshore PER. The field survey included general observation and assessment around upstream components of the Project including the well-pad areas, the P2C CPF area and the proposed onshore PER. In addition, 31 groundwater features (wells, bores and springs) were identified in the P2C CPF area and the onshore PER.

Since the 2016 groundwater survey, more recent sampling of water supply bores at Herd Base (BH-01, BH-02, BH-03 and BH-04) was undertaken (in August, October and December 2023, and February 2024). The depth from surface to groundwater in the four bores was recorded in August and October 2023 and ranged from 2.8 to 7.5 m. The results of these samples are described in “Groundwater Characterisation and Quality” below.

The 2016 groundwater survey found that isolated perched, shallow (less than 10 mbgl) groundwater occurs within superficial and weathered material throughout the study area but particularly in the areas of steep slopes and incised valleys within PRL-15. This is likely to support good quality water and to act as an important recharge source for stream and creek base flow.

At a regional level, little information regarding deeper groundwater within the competent geology of the Era and Orubadi formations is available. However, the lithologies that occur in these formations, including mudstones and siltstones are not considered likely to support significant groundwater occurrence, with the possible exception of sandstone horizons within the Era formation. Moreover, if groundwater is present in specific layers within these formations, the presence of low-permeability mudstones and siltstones would likely limit how easily the groundwater can move and interact. This interpretation is the basis for the conclusion that any groundwater occurrence within the Era or Orubadi formations would represent confined systems with little or no connectivity to overlying shallow aquifers or surface water in the study area.

It is also likely that small quantities of groundwater may occur within the geology of the gas resource target, the Kapau Limestone. The depth to this geology is in excess of 1,700 m and the thickness of overlying low permeability material is understood to have contained the hydrocarbon resource and will therefore effectively confine any water occurring in this unit.

The geological stratigraphy of the Project area is described in Table 6-21 in Soils and Geology.

In the context of the local development sites, the Elk and Antelope gas field area in the north of PRL-15 is characterised by steep slopes and incised valleys and experiences high rainfall. In this area localised bodies of shallow, unconfined, perched groundwater are thought to be present within superficial material including alluvium, colluvium, landslide debris and weathered material. This perched groundwater is considered likely to exist within 10 m of ground surface where present. Detail regarding deeper groundwater in this area is unknown though it is likely that permanent groundwater may be encountered in more extensive alluvial deposits in the major river valleys. This groundwater is likely to be in connectivity with surface water.

In summary, based upon the review of the available geological information with respect to groundwater within the study area, it is considered likely that four potential hydro-stratigraphic units (HSU) are present:

- Perched or shallow groundwater in Quaternary sediments.
- Shallow permanent groundwater within the Era beds, where they are present.
- Formation water within the Orubadi beds, which is not considered to represent an aquifer.
- Deep groundwater within the gas producing Kapau Limestone (>3500 mbgl).

The Orubadi formation is dominated by mudstones and siltstones likely to have low hydraulic conductivities, and may be considered an aquiclude which prevents migration of hydrocarbons and water into overlying formations.

Groundwater Abstraction and Utilisation

The description of the groundwater in the study area is based on existing information available from previous studies, the scientific literature and a field survey undertaken in PRL-15 and the onshore export pipeline corridor in November 2016.

Groundwater assessment in the study area to date has been limited, and little detail is known about the area's hydrogeology. The few groundwater access points in the study area comprise the Project's Herd Base abstraction bores in the southern area of PRL-15 adjacent to the Purari River. No known bores occur in the onshore export pipeline corridor. Groundwater springs are understood to be relatively common in the upper reaches of the study area, particularly during and following the wet season (GHD, 2015). Hand-dug village wells used for domestic water supply are common in the coastal areas. There is little quantitative data regarding groundwater levels or the water flow or quality from these shallow groundwater features.

The field survey involved general observations of the surrounding environment in PRL-15 and the onshore PER. Gauging and sampling was also undertaken of groundwater bores at Herd Base and of springs and shallow wells at coastal and inland villages along the onshore export pipeline corridor.

Forty-three sites were observed, gauged, sampled or sighted during the field survey. Thirty-one groundwater features (e.g., wells, springs or bores) were observed and documented, while observations of springs, seepages or erosional features were made at 12 additional sites, to inform groundwater conceptualisation. Of the 31 groundwater features documented (as noted in the introductory paragraph above), water levels were gauged at 28 sites; in situ water quality measurements were undertaken at 17 sites; and water samples were collected at 16 sites, of which 14 were analysed for general water quality parameters and contaminants, including metals, hydrocarbons and coliforms.

The suitability of groundwater for use as drinking water was assessed considering PNG PHR (NDPH 1984) and the WHO drinking water guidelines (WHO 2011).

The groundwater features assessed during the field survey fall into two categories:

- Drilled groundwater supply bores at Herd Base; or
- Hand dug or natural wells and springs in villages within the onshore export pipeline corridor.

The bores at Herd Base are between 16.80 and 22.56 m in depth, with groundwater levels measured to be from 3.04 to 6.51 meters below ground level (mbgl). The village wells and springs are between 1.0 and 2.68 m in depth, with groundwater levels measured in the range 0.05 to 2.06 m bgl.

The EIS (2019) identified that Pawaia communities north of Herd Base, located along the Purari River, have a relatively lower reliance on groundwater, primarily sourcing the majority of water from rivers, tanks and rainwater. The inland section of the onshore PER (approximately 10km from the coastline) is largely unpopulated. The 2016 field survey identified shallow groundwater to be present and used extensively by the communities of the coastal and inland villages (near the coast) within the onshore PER.

Groundwater usage within the study area is predominantly for washing but during dry periods there is extensive reliance on groundwater as a drinking water resource. The quality of the water encountered largely met the relevant quality criteria for intended use with respect to chemical properties. However, widespread microbiological contamination is evident. The groundwater resource targeted by coastal and inland villages is extremely shallow, generally being less than 1 m below ground level (mbgl) and therefore is highly susceptible to impact from potentially contaminating activities and processes. Identified risks include overland runoff (following rainfall) entraining contaminants particularly animal waste, sewage effluent from

latrines, inundation of wells by seawater and potential spills and/or mismanagement of hydrocarbons (e.g. boat fuel).

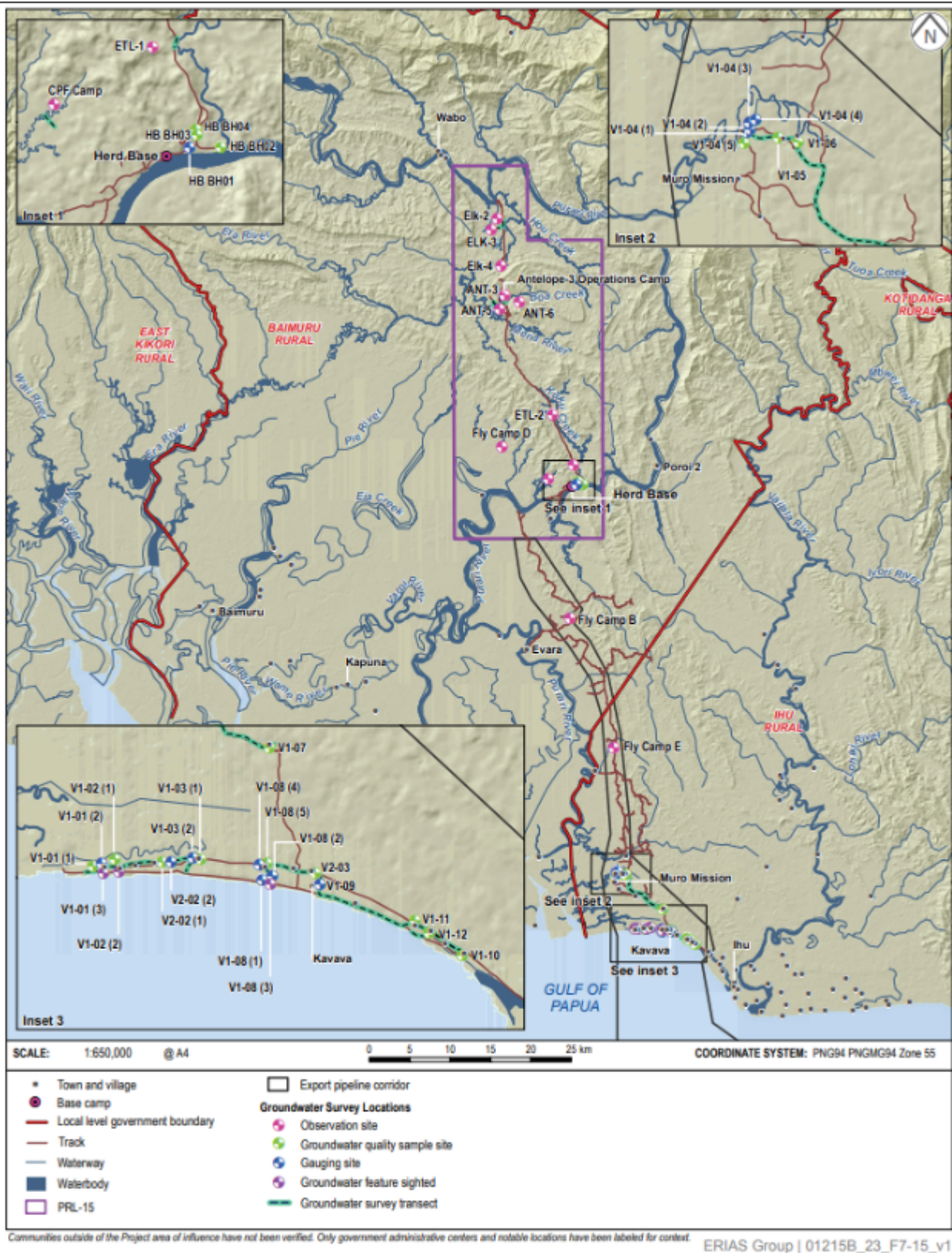


Figure 6-8: Groundwater wells observed in PRL-15 (Source: EIS Existing Environment – Terrestrial, 2019)

Groundwater Characterisation and Quality

As described above, additional groundwater sampling was undertaken at bore holes in the Herd Base area in December 2023 and February 2024, with results described below.

Measurements of pH showed groundwater to be slightly acidic to circumneutral at BH-01 to BH-03; and moderately alkaline at BH-04. The higher pH for BH-04 is consistent with higher levels of bicarbonate measured in water samples from this borehole. In comparison, the EIS (2019) reported groundwater to be moderately alkaline in all borehole water samples.

There was also more variability in electrical conductivity measurements during the recent sampling, ranging from 30 to 1,000 $\mu\text{S}/\text{cm}$ in August and October 2023, and 429 to 991 $\mu\text{S}/\text{cm}$ in December 2023 and February 2024. In comparison, the EIS (2019) reported conductivity ranging from 765 to 992 $\mu\text{S}/\text{cm}$. The water remains classified as representing fair drinking water based on aesthetic considerations, i.e., taste according to WHO (2022) drinking water guidelines.

It is to be noted, however, that appreciable levels of coliforms were measured in many of the samples collected. This suggests that this water may be in hydraulic communication with shallow groundwater and surface water, and sources of domestic sewage outfall either into the rivers or into shallow quaternary alluvium.

Concentrations of dissolved metals were low with most being less than the Limits of Reporting (LoRs), and lower than WHO (2022) drinking water guidelines and Schedule 2 of the PNG Public Health (Drinking Water) Regulation 1984. Levels of PAHs, BTEX and TPHs were less than LoRs in all samples, except for total TPHs in BH-03 in December 2023 (290 $\mu\text{g}/\text{L}$) and February 2024 (690 $\mu\text{g}/\text{L}$). No health-based limit for total TPHs is provided in drinking water guidelines.

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) were also measured in samples collected in August and October 2023, and February 2024. PFAS was detected in BH-03 during August 2023 (sum of PFAS being 0.11 $\mu\text{g}/\text{L}$) and October (0.15 $\mu\text{g}/\text{L}$) but was less than LoRs in February 2024. PFAS concentrations (all individual compounds and sum amounts) in all samples from other bores were less than the LoRs. The Australian PFAS National Environmental Management Plan (NEMP) (Heads of EPA Australia and New Zealand (HEPA), 2020) provides guidance on the management of PFAS contamination in the environment, with a drinking water guideline of 0.07 $\mu\text{g}/\text{L}$ derived for the sum of perfluorooctane sulfonate (PFOS) and perfluorohexane sulfonate (PFHxS). Notwithstanding the detection of PFAS in water from BH-03 on two sampling occasions, sum concentrations of PFOS and PFHxS were less than the LoR of 0.01 $\mu\text{g}/\text{L}$, and hence less than the drinking water guideline.

6.8.7 Hydrogeology Impact Assessment

The EIS (2019), the EIS Addendum (2024) and FEED Changes EAR (2025) identified the following potential impacts of the Project to groundwater:

- Groundwater contamination due to:
 - o Introduction of drilling muds and cuttings during the drilling of wells.
 - o Injection of produced water and liquid effluent from the flue gas desulfurisation process into Antelope reservoir in the event of well integrity issues.
 - o Acid gas injection into the acid gas reinjection wells in the event of well integrity issues.
 - o Accidental leaks of reservoir fluids from flowline/trunklines or condensate from the export pipeline.

- o Accidental hydrocarbon or chemical spills or leaks at Project facilities and various areas of activities.
- o Leachates from the general waste landfills.
- o Introduction of drilling muds and cuttings during HDD for Caution Bay shore crossing.
- Reduction in the quantity of shallow groundwater at inland and coastal villages due to drawdown in the pipeline trench.

The FEED Changes EAR (2025) describes that groundwater is expected to be encountered during borrow pit excavations at KP9, KP30 and KP60. The borrow pit locations also experience high rainfall, with direct rainfall and surface runoff requiring management along with encountered groundwater. The key issue in management of this water will be high levels of sediment expected in this water.

6.8.8 Hydrogeology Mitigation

Generally speaking, potential impacts to groundwater are avoided or minimised through Project design which is based on a risk-management approach, considering geotechnical constraints (e.g., flooding, landslides risks, geohazards) and anticipating and avoiding, or where avoidance is not possible, minimising E&S impacts (e.g., avoidance of sensitive features, physical and economic displacement, priority ecosystem services, and minimisation of Project footprint, land clearing and disturbance, emissions and discharges).

The Project proposes to manage groundwater impacts almost entirely through embedded design, with no additional stand-alone mitigation measures required. Key design controls include use of water-based drilling muds, full casing and cementing of wells to isolate any aquifers, and routine inspection, monitoring and maintenance of the gathering, reinjection and export pipeline systems (including instrumented pigging and wellbore/reservoir pressure monitoring) to maintain integrity and prevent leaks. Produced water and the flue gas desulfurisation liquid effluent will be injected into the Antelope Reservoir, while acid gas is injected into the reservoirs, all designed so injected fluids remain confined far below any usable groundwater.

For the gas and condensate transfer systems and supporting infrastructure, embedded design focuses on preventing shallow groundwater contamination from accidental releases and landfill leachate, and on limiting trench-related drawdown in village wells. The onshore export pipelines are trenched to about 2.3 m depth where they intersect very shallow village aquifers (<1–2 m bgl), and the EIS (2019) describes a broader suite of embedded controls to prevent hydrocarbons, chemicals, produced water and landfill leachate entering groundwater. Fuel storage, refuelling, chemical storage and landfills (including sewage sludge disposal) are all to be designed, located and managed in accordance with these controls so that any spills or contaminated drainage are contained and treated before discharge, thereby limiting both contamination of shallow village wells and any reduction in available groundwater caused by trench dewatering.

Where monitoring, consultation or the community grievance mechanism identifies unforeseen Project-related impacts on water availability, the Project will investigate the issue with affected users and implement corrective or remedial measures consistent with the stakeholder engagement process and community grievance mechanism.

Table 6-26: Mitigation measures - Hydrogeology

Impact	Mitigation code (As in MP)	Description	Source document
Contamination from discharges and accidental releases	EM008	Sewage effluents from project facilities will be treated to meet the environment (waste discharge) permit before discharge, in accordance with applicable standards.	<i>EIS/ Upstream CESMP; 2019</i>
	EM011	Water from trenches will be discharged in accordance with applicable water quality standards with erosion and sediment controls where relevant.	<i>EIS/ Upstream CESMP; 2019</i>
	EM016	Training and test releases of firefighting foams at the CPF are to be contained within appropriate drainage water treatment networks	<i>EIS/ Upstream CESMP; 2019</i>
	EM017	Vehicle wash down and fuel handling will be undertaken considering possible receptors e.g., streams, Purari River and the marine environment	<i>EIS/ Upstream CESMP; 2019</i>
	EM018	An Emergency Response Plan will be developed to effectively manage the preparedness and response to emergency events. It will contain: • Site contingency plans, that will consider fire management measures. • An Oil Spill Contingency Plan, that will consider spill risks for construction, operation and decommissioning of facilities and associated infrastructure, and supply services on land and in aquatic and marine environments. • A Blow Out Contingency Plan including well blowout control and contingency measures.	<i>EIS/ Upstream CESMP; 2019</i>
	EM019	Vessels will be required to have shipboard Oil Pollution Emergency Plans/Oil Spill Contingency Plans as per TotalEnergies requirements and Marine Pollution (Ships and Installations) Act 2013.	<i>EIS/ Upstream CESMP; 2019</i>
	ED003	Adopt standard industry practices to prevent and protect against soil/water contamination, due to Project activities, such as: • Preparing hydrocarbon and chemical management procedures, as part of the Hazardous Materials Management Plan. • Building infrastructure on impervious surfaces where required.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		- Providing permanent fuel and chemical stores, and maintenance and refueling areas with secondary containment of an appropriate volume to prevent loss to the environment or mixing with incompatible materials. - Installing interceptor pits or similar to collect contaminated surface water runoff and treat where required. - Installing tanks above ground with impermeable liners and bunds around tanks. - Regularly inspect and maintain the containers, storage and transfer infrastructure to prevent/control spills or leaks. - Installing readily accessible spill kits and training staff in their use. - Appropriately treating and disposing of any accidentally contaminated soils.	
	ED006	Minimise chemical use and select chemicals considering the following criteria: - Lowest toxicity, lowest bioaccumulation potential and highest biodegradation; - Chemicals subject to bans or phase-outs.	<i>EIS/ Upstream CESMP; 2019</i>
	ED010	Wells are to be cased and cemented to insulate and protect any aquifers	<i>EIS/ Upstream CESMP; 2019</i>
	ED011	The gathering and reinjection system, and wells and export pipeline system will be routinely inspected, monitored and maintained, as part of operational control (including pipeline and instrumented pigging, well wellbore and reservoir pressure monitoring).	<i>EIS/Upstream CESMP; 2019</i>
	ED020	Rainwater infiltration into hazardous materials storage areas will be prevented.	<i>EIS/ Upstream CESMP; 2019</i>
	ED021	Requirements for hazardous material transfer, overfill protection, and alarms will be implemented, e.g.: - Using dedicated fittings, pipes, and hoses specific to materials in tanks. - Providing secondary containment, drip trays, etc. at connection points or other possible overflow points.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		- Using dripless hose connections for vehicle tank and fixed connections with storage tanks. - Providing automatic fill shutoff valves on storage tanks to prevent overfilling. - Using piping connections with automatic overfill protection (float valve). - Fitting tanks with high-level alarms with both audible and visible annunciation.	
Deterioration of groundwater levels and/or flow due to earthworks	EM011	See above	<i>EIS/ Upstream CESMP; 2019</i>
Deterioration of groundwater levels and/or flow	EM015	Hydrotest water management will consider: - The definition of volume and discharge rates and discharge locations. - Chemicals additives selection, according to requirements defined in embedded design controls. - Reusing hydrotest water to minimise the discharge volume. - Reducing the need for chemicals by minimising the time hydrotest water remains in the pipeline. - Monitoring hydrotest water discharges to the environment against applicable limits.	<i>EIS/ Upstream CESMP; 2019</i>
	EM020	Maintain hydraulic and biological connectivity during construction and operations in natural flow lines across linear infrastructure, such as pipelines and roads, and in relation to water extraction, e.g. dams, including: - Install appropriately sized culverts, drains and structures to allow fish passage, according to good international industry practice standards. - Rehabilitate waterways after construction and decommissioning to a sustainable, stable state, that reflects the original character, and maintains waterway flows and connectivity.	<i>EIS/ Upstream CESMP; 2019</i>
	ED040	Hydrotest water discharges will be managed according to applicable requirements.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
Changes to hydraulic process and sedimentation	EM004	Erosion and sediment control measures will be implemented for infrastructure components in accordance with good international industry practice to effectively manage stream and river flows, stormwater, surface erosion, sedimentation and scour, e.g., drainage diversion into surrounding vegetation, rip-rap aprons, rock armoring, energy dissipators, sediment control ponds, mulch berms and sediment fences, where required, until the area has been effectively stabilised and/or rehabilitated.	<i>EIS/ Upstream CESMP; 2019</i>
	EM009	Backfill trenches as soon as practicable after disturbance, using material originally excavated from the trench as much as possible. The backfilled trenches should not exceed the preconstruction levels after the material has settled.	<i>EIS/ Upstream CESMP; 2019</i>
	EM002	Progressively clear vegetation and rehabilitate cleared areas as soon as practicable to minimise the time cleared areas are exposed; and allow fauna to move away from areas to be cleared, where practicable.	<i>EIS/ Upstream CESMP; 2019</i>
	EM003	Cut trees where practicable to retain the rootstock and maintain soil stability.	<i>EIS/Upstream CESMP; 2019</i>
	EM005	Stabilise spoil stockpiles and areas of ground disturbance as soon as practicable after initial disturbance using, e.g., mulched vegetation, aggregates and soil binders	<i>EIS/Upstream CESMP; 2019</i>
	EM006	Areas of higher risk of landslides e.g., steep gradients, previously disturbed land, likely to occur from the works, or likely to be exacerbated by the works, will be stabilized to reduce the landslide risk.	<i>EIS/Upstream CESMP; 2019</i>
	EM010	Minimise or avoid sidecasting during construction (e.g. for road, pipeline, wellpad and CPF works). Any sidecasting that does occur will avoid defined stream channels.	<i>EIS/Upstream CESMP; 2019</i>
	EM011	See above	<i>EIS/Upstream CESMP; 2019</i>
	EM012	Maintain buffer zones between permanent surface water and Project infrastructure, except to carry out works associated with the construction of watercourse crossing or where facilities are proposed to be located within that buffer.	<i>EIS/Upstream CESMP; 2019</i>
	EM013	Minimise in-stream and stream bank disturbance during high rainfall.	<i>EIS/Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
Leachage	ED005	The landfill will be designed to comply with TotalEnergies' general specification for landfills, and will be designed, located, constructed and operated in general accordance with the intent of the Code of Practice for Sanitary Landfill Sites (DEC, 2001) and other applicable standard industry practices.	<i>EIS/Upstream CESMP; 2019</i>
Drilling fluids	TBC	For Caution Bay shore crossing by HDD, additional mitigation measures have been identified. Specifically, the risk of occurrence of frac outs during HDD will be minimised by: • Conducting detailed geotechnical investigations to understand ground conditions along bore path to inform assessment of the risk of frac out and avoid paths in weak zones. • Installing casing at the entry point where reduced cover and bearing pressure exists. • Continual monitoring of drilling fluid pressures and losses during drilling and if unexpected variations or trends are observed cease drilling, investigate causes and implement remedial measures.	<i>FEED Changes EAR; 2025</i>
	ED004	The drilling will be performed using water-based mud.	<i>EIS/Upstream CESMP; 2019</i>

6.8.9 Hydrogeology Residual Impact Assessment

Table 6-27 below provides a summary of the assessment of residual impacts to hydrogeology and groundwater resulting from the described Project activities, including in which Project phase and location impacts may occur. All residual impacts to groundwater are assessed to be Negligible to Minor.

Table 6-27: Summary of potential residual impacts - Hydrogeology/groundwater

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual - Sensitivity / magnitude	Residual - Significance
Groundwater quality	Drilling of wells	Groundwater contamination due to the introduction of drilling muds and cuttings	PRL-15 (wellpads)	C	EM008EM011	Minimal/Low	Negligible
			HDD at Caution Bay shore crossing	C	EM017 EM016	Low/Minimal	Negligible
	Produced water reinjection	Groundwater contamination due to reinjection of produced water in case of well integrity issues	Antelope gasfield	O	EM018 EM019 EM020 ED004	Minimal/Low	Negligible
	Acid gas reinjection	Groundwater contamination due to reinjection of acid gas in case of well integrity issue	Elk and Antelope gasfield	O	ED040 TBC	Minimal/Low	Negligible
	Pipeline operations	Groundwater contamination due to accidental leaks of reservoir fluids from the flowline/trunklines or condensate from the export pipeline.	Elevated areas of PRL-15 and the export pipeline route	O		Minimal/Minimal	Negligible
			Adjacent to creeks and rivers in PRL-15 and along the export pipeline route.	O		Medium/Minimal	Negligible
			Coastal and inland villages along the export pipeline route.	O		High/Minimal	Minor
	Use of hazardous materials	Modified groundwater flow and groundwater contamination from, increased sedimentation and erosion, and accidental hydrocarbon or chemical spills or leaks	CPF P3 Site	C, O, D	EM018	Minimal/Minimal	Negligible
			Earthworks for borrow pit and access track in elevated areas of PRL-15 (Elk-2)	C	EM017 EM016 ED003	Minimal/Minimal	Negligible
			Earthworks for borrow pits and access tracks for lower elevation areas in PRL-15 and along export pipeline route (KP9, KP30, KP54)	C	ED006 ED020 ED021 EM004 EM009 EM002 EM005 EM006 EM012 EM013 EM015	Medium/Minimal	Negligible
			Earthworks for borrow pits and access tracks near coastal and inland villages along export pipeline route (KP60)	C	EM018 EM017 EM016 ED003	High/Minimal	Minor

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual - Sensitivity / magnitude	Residual - Significance
					ED006 ED020 ED021 EM004 EM009 EM002 EM005 EM006 EM012 EM013 EM015		
			HDD at Caution Bay shore crossing	C	TBC	Low/Minimal	Negligible
		Groundwater contamination due to accidental leaks of reservoir fluids from flowline/trunklines of condensate from the export pipeline	Areas adjacent to creeks and rivers in PRL-15 and along the export pipeline route	C, O	EM018 EM017 EM016 ED003 ED006 ED020 ED021	Medium/Minimal	Negligible
		Groundwater contamination from accidental hydrocarbon or chemical spills or leaks at Project facilities and various areas of activities	Coastal and inland villages along the export pipeline route.	C, O	ED005 EM001 EM018 ED003 ED006 ED020 ED021	High/Minimal	Minor
	Landfill construction and operation	Groundwater contamination due to leachates from the general waste landfill	PRL-15	C, O, D	ED005	Medium/Low	Minor
Groundwater quantity	Drawdown from borrow pits	Reduction in the shallow groundwater quantity at inland and coastal villages due to the groundwater drawdown into the pipeline trench	Coastal villages along the export pipeline route	C	None	High/Minimal	Minor

Notes: C = construction, O = operations, D = decommissioning

6.9 Resource and Waste Management

6.9.1 Introduction

This section presents a synthesis of Project documentation relating to resource, Project materials and waste management. This section is divided into two, presenting the baseline, impact assessment, mitigation, and residual impact assessment relating to resource management initially, followed latterly by the same findings but related to waste management.

Resource Management

This section focuses on aggregate and quarried material required for the construction of wellpads, roads, pipe-laying, the CPF and accommodation and logistics base.

Assessments have examined options for obtaining aggregate and quarried material from within PRL-15, elsewhere within PNG, as well as options for importing material from quarries in Australia, the latter which were excluded early in the assessment process due to the requirement and complexities of quarantining and sterilising large volumes of material.

Quantities and volumes of other materials critical to the construction and operation of the Project such as water, diesel, cement, concrete batching aggregate, steel reinforcement bar and other steel products, as well as process facility equipment, well-casing, pipelines, drilling mud materials and other bulk materials that will be transported to PRL-15 will be defined during detailed engineering. Information pertaining to material transport logistics, materials storage and warehousing will similarly be defined during detailed engineering.

Waste Management

This section presents a synthesis of Project documentation relating to the baseline, impact assessment and mitigations for waste management.

The construction and operation of the Project will generate large volumes of non-hazardous and hazardous waste. If these waste streams are not managed appropriately this could result in environmental degradation resulting in contamination of soil, groundwater, surface water, impacts to ecosystems and human health.

The Project will manage its waste during all Project stages from preparatory works to decommissioning in alignment with TotalEnergies' general specifications, relevant PNG legislation and guidelines, and relevant international conventions, including the relevant IFC PSs. Accordingly, a project Waste MP (2024) and a Waste Management Procedure (2023), hereafter referred to as Waste Mgmt Proc., (2023), are in place. Strategies will be implemented to align with the waste mitigation hierarchy as below:

- Reduce – where possible, reduce waste volumes at the source by selecting processes, products and procedures that generate the least waste possible.
- Reuse – where possible, packaging materials will be returned to suppliers for reuse, e.g., empty drums and containers, cardboard and unused products.
- Recycle and recover – where possible, hazardous and non-hazardous wastes, e.g., scrap metal, rubber tires, batteries, empty gas cylinders, will be reprocessed into useful materials or products by third parties.

Treatment and disposal – if waste materials are still generated after the implementation of feasible waste avoidance, reduction, reuse, recycling and recovery measures, waste materials will be treated and disposed of, and measures taken to minimise potential impacts to human health and the environment.

6.9.2 Resource Management Baseline

The Project will need to establish multiple aggregate and fill material extraction sites within PRL-15 and adjacent to the export pipeline route, and possibly source material from new and existing facilities outside of PRL-15, to meet aggregate requirements. A range of aggregate materials comprising sands, gravels and rock are required for structural fill and drainage, general fill and road course. Aggregates are essential for effective drainage and to ensure structural stability. As described previously in Section 3.1 approximately 2.7 MT of aggregate will be needed to support Project activities. The Project will secure aggregate from three sources, quarries, borrow pits and dredging sites.

A primary source of aggregate will be dredging of the Purari River at Hou Creek. Sampling of bed sediment of the Purari River at Hou Creek in 2016 showed sediment composition was 65% sand (0.06 to 2 mm) and 30% gravel (2 to 60 mm), as published in EIS Surface Water & Sediment Quality Baseline, 2017. Results from the 2023 bed sediment sampling of the Purari River downstream from Hou Creek, reported in D&B ESIA (2025), were consistent with these results. The sediment fractional composition showed that sand was the dominant fraction in this reach, ranging from 67 to 97%. The gravel content ranged from 1 to 32%.

According to the Hou Creek Aggregate Dredging EAR (2025) aggregate will be extracted from two areas. A total of 1,315,000 m³ of material is available to be extracted over an approximate 3-year period. Aggregate extraction at Hou Creek will target alluvial sand, gravel and rock deposits from the riverbed. It is likely that some finer and more undesirable material (i.e., silt) will be contained within the targeted aggregate. Areas with this material will be avoided where possible; however, if extracted this material will be treated as spoil. It is estimated that approximately 30% of the extracted material (395,000 m³) will be unsuitable for use as aggregate but could be used in the construction of temporary facilities (site access, site installation).

A secondary option for sourcing material is from commercial quarries in Port Moresby.

Borrow pits for additional material have been identified within PRL-15 and along ridges outside PRL-15 where material can be extracted and are generally located within 5km of the pipeline route. There is a previously used and now exhausted borrow pit located within the perimeter of the proposed CPF site.

6.9.3 Resource Management Impact Assessment

The EIS (2019) identifies a range of potential impacts associated with aggregate sourcing from quarries. These are summarised as follows:

- Clearing of native vegetation within quarry footprint and access areas
- Habitat loss and fragmentation affecting terrestrial fauna species
- Potential disturbance or loss of habitat for threatened or protected species
- Reduction in ecological integrity within quarry development area
- Soil erosion and land degradation from clearing and extraction activities
- Increased sediment runoff to nearby watercourses
- Potential localised changes to drainage patterns
- Dust generation from blasting, crushing, stockpiling and haulage
- Noise and vibration impacts from blasting and heavy machinery
- Generation of spoil and overburden material
- Long-term landscape scarring if not rehabilitated properly
- Introduction or spread of weeds via machinery and disturbed ground

- Temporary disturbance from transport of aggregate materials.

Regarding dredging of aggregate, impacts pertain to the construction phase of the Project when the material would be sourced for construction purposes. Decommissioning of the Hou Creek Aggregate Dredging operation would involve leaving the site in a stable condition for natural regeneration.

Potential impacts identified in the Hou Creek Aggregate Dredging EAR (2025) are described as follows:

Table 6-28: Potential impacts of Hou Creek dredging (Source: Hou Creek Aggregate Dredging EAR (2025))

Environmental Component	Potential Impact
Landform and soils	Excavations and earthworks destabilising landforms causing increased incidence of landslides or mass movements along the river banks.
	Degradation of soil capacity due to impacts on soil structure and developmental status, fertility or disturbance of soil profiles from earthworks.
	Degradation of soil capacity due to adverse chemical properties caused by: • Disturbance of acid sulphate soils (ASS) during earthworks. • Soil contamination from accidental hydrocarbon or chemical spills or leaks.
Hydrology, fluvial geomorphology and sediment processes	Alterations to hydrology, flow characteristics and scouring due to dredging to extract aggregate.
	Increased total suspended solids (TSS), turbidity and sedimentation of waterways due to aggregate dredging in the Purari River and earthworks at the Hou Creek base.
Surface water quality	Surface water contamination from accidental hydrocarbon or chemical spills.
Freshwater biodiversity	Direct loss or disturbance of aquatic habitat due to dredging of the Purari River.
	Loss of turtle nesting beaches.
	Adverse impacts on aquatic fauna due to increased levels of TSS, turbidity and sedimentation in waterways due to dredging of the Purari River and earthworks at the Hou Creek base.
	Toxicity effects on aquatic fauna due to accidental hydrocarbon or chemical spills.
	Vessels or aggregate dredging equipment striking or entraining aquatic fauna on the Purari River.
	Introduction or spread of invasive species, diseases and pathogens from construction vehicles/machinery and dredging vessels.
	Physiological injury or behavioural disturbance to freshwater fauna due to underwater noise in the Purari River. (Impacts vary according to species. Refer to Hou Creek Aggregate Dredging EAR, 2025)
Terrestrial biodiversity	Habitat loss and fragmentation, including loss of important features and impacts from barrier effects.
	Habitat degradation, including impacts from edge effects, erosion and movement of soil and spoil, sedimentation and contamination of waterways, reduction in air quality, fire, deforestation.
	Natural regeneration failure following vegetation clearing.
	Loss of individuals and populations (both fauna and flora).
	Mortality or injury to fauna, including from vehicle strike and tree felling operations.
	Disturbance to fauna and focal breeding and roosting sites; for example, through noise and light emissions.
	Introduction and spread of invasive alien species, including weeds, pests and pathogens.
	Indirect impacts from social and commercial aspects, including increased hunting, exploitation of forest resources and clearing of land for housing and gardens.

Environmental Component	Potential Impact
Socio-Economic	Transport and Access: • Short-term Disturbance of Access to Community Services or Natural Resources • Loss or Damage of Assets due to Increased River Traffic
	Economic Displacement and Livelihoods: • Reduced livelihood of PAPs living in and around Hou Creek • Restrictions or controls to access to land due to aggregate dredging operations due to (restricted or controlled) land access • Reduced livelihood of PAPs due to impacts to aquatic resources • Increase in community tension due to disparity in compensation payments

The impact assessment pertaining to materials required for the operation of the Project will be conducted consequent to the provision of the Bill of Quantities (BoQ) and known origins and supply of those materials. The sourcing of materials is expected to follow and will be mitigated appropriately in accordance with Raw Materials Management Plan (2023) hereafter referred to as Raw Materials MP (2023), as well as TEP PNG's guidance for the procurement of materials.

Right of Way Vegetation Clearance

According to the EIS (2019), early works construction activities will include removing above-ground vegetation and rock from the pipeline RoW. Any trees and large shrubs requiring removal will be felled and stockpiled adjacent to the RoW. Stockpiled vegetation will be conserved where practicable for reuse after construction to assist with erosion control, serve as mulch and provide a seed source for natural regeneration.

Vegetation clearing will be in two stages: firstly a 5-m wide track will be manually cleared, and then the full width of the RoW will be cleared using machinery, with cut trees reused to reinforce the working tracks.

6.9.4 Resource Management Mitigation

TEP PNG's Project Raw Materials Management Procedure for Preparatory Works, hereafter referred as Raw Materials Mgmt Proc., (2023) outlines measures to avoid and minimise the potential adverse impacts relating to the extraction and harvesting of raw materials during the construction phase of the Project, which include both timber and material sourced from quarries.

As described above, timber felled during site clearance will be re-used for road construction and erosion control with PLR-15, while brash and ground vegetation will be stockpiled for mulch and retention of seed source for forest natural regeneration.

The EIS (2019) identifies a number of mitigation measures to be applied during aggregate sourcing from quarries. Regarding the proposed dredging operations at Hou Creek, mitigation measures to address dredging impacts will be implemented in accordance with the specifications and requirements presented in Project environmental and social management plans and procedures. A Hou Creek Aggregate Dredging Management Plan will be developed that will contain a range of site-specific mitigation management measures. An overview of relevant mitigations measures for both of these are identified as follows, the full list being detailed in other relevant sections of this report:

Table 6-29: Mitigation measures - Resource management

Impact	Mitigation code (As in MP)	Description	Source document
Vegetation Clearing	EM002	Progressively clear vegetation and rehabilitate cleared areas as soon as practicable to minimise the time cleared areas are exposed; and allow fauna to move away from areas to be cleared, where practicable.	<i>EIS/Upstream CESMP; 2019</i>
Threatened Species and Habitat Loss	EM001	All sites proposed for development as part of the Project will be subject to a pre-clearance survey to clearly identify acid sulphate soils, sensitive sites and habitats, e.g. roosting, breeding, nesting and threatened species sites, priority ecosystem services, archaeological sites, burial sites, sites of religious importance to be subject to specific mitigation measures.	<i>EIS/Upstream CESMP; 2019</i>
	EM022	Implement lower speeds past aquatic fauna when observed in the water.	<i>EIS/Upstream CESMP; 2019</i>
	EM021	Minimise fish entrainment by water extraction equipment, e.g., screens.	<i>EIS/Upstream CESMP; 2019</i>
Habitat Fragmentation	EM020	Maintain hydraulic and biological connectivity during construction and operations in natural flow lines across linear infrastructure, such as pipelines and roads, and in relation to water extraction, e.g. dams, including: • Install appropriately sized culverts, drains and structures to allow fish passage, according to good international industry practice standards. • Rehabilitate waterways after construction and decommissioning to a sustainable, stable state, that reflects the original character, and maintains waterway flows and connectivity.	<i>EIS/Upstream CESMP; 2019</i>
Soil Erosion and Sedimentation	EM004	Erosion and sediment control measures will be implemented for infrastructure components in accordance with good international industry practice to effectively manage stream and river flows, stormwater, surface erosion, sedimentation and scour, e.g., drainage diversion into surrounding vegetation, rip-rap aprons, rock armoring, energy dissipators, sediment control ponds, mulch berms and sediment fences, where required, until the area has been effectively stabilised.	<i>EIS/Upstream CESMP; 2019</i>
Ground Disturbance	EM036	Where possible, separate and stockpile cleared topsoil (with the inherent seed bank and any coarse woody debris) to use for future rehabilitation.	<i>EIS/Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
Dust Generation	EM041	Implement dust control, where required.	<i>EIS/Upstream CESMP; 2019</i>
Noise and Vibration	EM046	Limit construction work, where practicable, to daytime hours.	<i>EIS/Upstream CESMP; 2019</i>
	ED019	All vehicles (including vessels and aircraft) and machinery, plant and equipment will be regularly maintained to the manufacturer's specifications; defective items will be removed from service until they are repaired.	<i>EIS/Upstream CESMP; 2019</i>
	ED032	The Project will design its plant and undertake activities to comply with the applicable noise criteria.	<i>EIS/Upstream CESMP; 2019</i>
Waste Management	EM030	Dispose of excess spoil material from Project earthworks in designated spoil disposal sites.	<i>EIS/Upstream CESMP; 2019</i>
Weed Spread	EM028	All Project personnel, workers, contractors and 3rd party operators will be educated during inductions and safety training about: • Fire risks, including the heightened risk during extreme drought years and smoking. • Wildlife values. • Weed, pathogen and animal pest hygiene and control measures. • Identification of cultural heritage, cultural heritage awareness, measures for avoiding impacts and the Chance Finds Procedure.	<i>EIS/Upstream CESMP; 2019</i>
	EM023	Management controls will be developed for weed, pathogen and pest that pose a significant threat to biodiversity, including: • Specific risk-based control methods, and procedures targeting Priority 1 and 2 weeds and pest fauna. • A quarantine management program for moving people, equipment and supplies in accordance with PNG law. • Tools for field personnel to identify Priority 1 and 2 weeds and pest fauna.	<i>EIS/Upstream CESMP; 2019</i>
Long-term Landform Impacts	EM029	Actively or passively rehabilitating bare sites as soon as possible to promote a stable self-sustaining landscape. e.g.:	<i>EIS/Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		• Allow forest edges to naturally regenerate or create appropriate conditions to facilitate natural regeneration, e.g. rip the substrate, replace topsoil, apply mulch. • Rehabilitate Pandanus habitats, e.g. recreate mounds, re-instate the intertidal surface between Pandanus mounds. • Rip compact surfaces across the slope, as appropriate, to facilitate revegetation and minimise erosion. • Spread stockpiled topsoil, organic matter and cleared vegetation over the rehabilitation area to promote natural regeneration. • Use native vegetation to revegetate sites when active rehabilitation measures are required.	
Accidental Spills	EM018	An Emergency Response Plan will be developed to effectively manage the preparedness and response to emergency events. It will contain: • Site contingency plans, that will consider fire management measures • An Oil Spill Contingency Plan, that will consider spill risks for construction, operation and decommissioning of facilities and associated infrastructure, and supply services on land and in aquatic and marine environments. • A Blow Out Contingency Plan including well blowout control and contingency measures.	<i>EIS/ Upstream CESMP; 2019</i>
	ED003	Adopt standard industry practices to prevent and protect against soil/water contamination, due to Project activities, such as: • Preparing hydrocarbon and chemical management procedures, as part of the Hazardous Materials Management Plan. • Building infrastructure on impervious surfaces where required. • Providing permanent fuel and chemical stores, and maintenance and refuelling areas with secondary containment of an appropriate volume to prevent loss to the environment or mixing with incompatible materials.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		• Installing interceptor pits or similar to collect contaminated surface water runoff and treat where required. • Installing tanks above ground with impermeable liners and bunds around tanks. • Regularly inspect and maintain the containers, storage and transfer infrastructure to prevent/control spills or leaks. • Installing readily accessible spill kits and training staff in their use. • Appropriately treating and disposing of any accidentally contaminated soils.	

6.9.5 Resource Management Residual impacts

The EIS (2019) concludes that, following implementation of the proposed avoidance, mitigation and management measures, the residual impacts associated with quarrying for aggregate are Negligible to Minor. Residual effects are generally confined to the approved disturbance footprint and are localised, short- to medium-term in duration, and reversible through progressive rehabilitation and closure measures. For further details, refer to section 6.16.6 for impacts to vegetation terrestrial fauna habitat and biodiversity values. Section 6.7.5 for soil stability, section 6.8.5 for surface water quality, section 6.4.5 air quality (dust) and section 6.6.5 for noise and vibration all of which are reduced to Minor levels through application of controls such as footprint restriction, pre-clearance ecological surveys, erosion and sediment management, dust suppression, and staged rehabilitation. Most of the residual impacts resulting from the dredging of the Purari River, following the implementation of mitigation measures, been ranked between Negligible and Minor, except for contamination from accidental hydrocarbon or chemical spills during dredging on surface water, which is Moderate (Hou Creek Aggregate Dredging EAR (2025)).

6.9.6 Waste Management Baseline

Existing Waste Facilities

A preliminary review of existing waste management facilities for the preparation of the EIS (2019) indicated that there was limited or no known waste management facility in Gulf Province and limited capacity in PNG in general. Waste management facilities have been identified by the Project in Port Moresby and at the LNG Plant in Caution Bay, both of which have waste incineration facilities. Waste management capacity is further confirmed in Waste Mgmt Proc. (2023).

Project Waste Quantities

A preliminary estimate of waste types and quantities for the Project is provided in the Table 6-30 below. It is anticipated that more comprehensive waste quantities will be determined during the Detailed Engineering phase.

Table 6-30: General waste types and estimated total quantities

Waste Stream	Classification	Estimate of Total Waste Generated (m ³)*	
		Early Works / Construction (5-years)	Operations (20-years)
Batteries	Hazardous	225	92
Container, drums, paints, solvents	Hazardous	450	184
Electrical waste	Non-hazardous	300	120
Food and domestic waste	Non-hazardous	7,461	2,920
Glass	Non-hazardous	400	164
HDD [#] drill cuttings	Non-hazardous	48,500	-
Medical waste	Hazardous	35	14
Oily debris	Hazardous	500	204
Paper and cardboard	Non-hazardous	65,000	26,581
Plastics	Non-hazardous	20,000	8,179
Rubber and tires	Non-hazardous	5,000	2,045
Scrap metal	Non-hazardous	31,500	12,882
Scrap wood	Non-hazardous	50,000	20,447
Waste oil	Hazardous	4,750	1,942
Chemical waste from gas processing	Hazardous	-	80
Oil sludge from gas processing	Hazardous	-	164
Solvents, chemicals, paints	Hazardous	0.9	4
Total estimate per phase		234,122	76,022
Total with 10% contingency		257,534	83,624
*Decommissioning wastes are excluded from the table. # Horizontal directional drilling		341,158	

6.9.7 Waste Management Impact Assessment

Non-hazardous Waste

Project activities including site preparation and earthworks, civil works and building and plant construction will produce unavoidable waste streams, which will require management and disposal.

Most burnable waste will be incinerated at an approved incinerator(s), while non-hazardous waste that cannot be incinerated will be recycled or re-used where practicable, or disposed of at the Project general waste landfill to be constructed in PRL-15 or, where appropriate, will be transported to Port Moresby for recycling, re-use or disposal. Landfilling of waste is to be avoided and used as a last option as per the waste management hierarchy.

Failure to appropriately store and dispose non-hazardous wastes may have the following impacts:

- Degraded quality of land and/or water.
- Degraded habitats and negative effects on species' health.
- Favourable conditions for invasive species to establish which could displace native species.
- Health declines and safety issues for the Project workforce and surrounding communities.
- Loss of aesthetic value.

Table 6-31 below identifies the Project activities that may generate non-hazardous waste streams, and associated impacts. Impacts are described in further detail in the EIS (2019) chapters on terrestrial, marine, social, and amenity and climate change.

Table 6-31: Project activities and impacts related to the improper management of non-hazardous waste

Project Activity	Source/Pathway	Impact
Vegetation clearing and spoil disposal.	Contamination/modification of the environment in a manner which can create favourable conditions for invasive species e.g., weeds.	Introduction, establishment and spread of invasive species which could displace native species.
		Habitat degradation, loss and fragmentation.
		Decline in native flora and fauna health.
Storage, transport and disposal of general waste	Improper management, disposal or storage of generated waste, including food waste near sensitive receptors (i.e., communities).	Contamination of terrestrial and aquatic environments.
		Increase in vector-borne disease rates, frequency and severity of outbreaks.
		Decline, loss or change to visual amenity.
	Improper or incineration.	Generation of combustion emissions and air pollution
Use of the PRL-15 authorised landfill and/or the Port Moresby Landfill.	Improper disposal of waste (i.e., waste not disposed at landfill, or poor landfill integrity).	Adverse human health effects (e.g., to eyes and/or respiratory system).
		Decline, loss or change to visual amenity.
Storage / Disposal of flammable general waste materials.	Improper disposal of waste (i.e., waste not disposed at landfill, or poor landfill integrity).	Groundwater contamination from leachate.
		Fire impacting wildlife, personnel or facilities.

Hazardous Waste

Unavoidable hazardous waste streams will be generated during the Project's construction activities.

All restricted waste (also referred to as Hazardous Waste) will be removed from PRL-15 and sent to Port Moresby for management, or exported under licence and in accordance with national laws and international agreements for management and disposal overseas, notably the 1989 UN Basel Convention on the control of Transboundary movements of Hazardous waste and their disposal. Specific requirements for the management of hazardous wastes will be developed should they arise.

Any inappropriate management and disposal of hazardous waste could have adverse impacts on the environment and human health.

Inappropriate management and disposal of hazardous waste might adversely impact:

- Soil quality
- Groundwater quality
- Surface water quality
- Aquatic and marine biota
- PACs using soil for agriculture, or surface or groundwaters for domestic purposes
- Project workforce.

Table 6-32 identifies Project activities related to the improper disposal of hazardous waste that may impact sensitive receptors.

Table 6-32: Project activities and impacts related to the improper management of hazardous waste

Project Activity	Source/Pathway	Impact
Generation, management and disposal of hazardous waste	Improper storage or disposal of hazardous waste, providing opportunities for it to leach into the surrounding environment.	Degraded soil capacity due to soil contamination.
		Surface water contamination.
		Groundwater contamination.
		Deterioration in marine water quality.
		Health impacts to communities or workers exposed to contaminated soil or water.
Drilling	Introduction of drilling muds during the drilling of wells.	Groundwater contamination.
		Soil contamination.
Training exercises	Discharging firefighting foams during training and testing which could run off into the surrounding environment	Soil, surface water and/or groundwater contamination.

6.9.8 Waste Management Mitigation

The Project has adopted an approach to waste management to be consistent with good international practice (including IFC PS3 and IFC PS4, and national legislation).

Current waste management proposals emphasise the requirement for TEP PNG to provide solutions for the cradle-to-grave management of all non-hazardous and hazardous wastes generated during the Project.

Accordingly, TEP PNG has reviewed the waste management requirements and infrastructure needs for construction and operation phases. This includes the requirements for pre-treatment (which may include incineration) and landfill construction. Broadly, options to address non-hazardous wastes include reuse where appropriate, recycling, composting, incineration and landfill. Options to address hazardous wastes include recycling, physico-chemical treatment, permitted discharges and incineration.

Waste Mitigation Strategy

TEP PNG's Waste Strategy (document L2-PLN-HSE-07) requires the following:

- Develop and implement a forward-looking WMP, ensuring that maximum effort is given to waste prevention, reduction, reuse and recycling
- Annual performance targets and objectives:
 - o 95% of all scrap metal to be recycled
 - o 70% waste valorization (recovery/recycling) by 2030
 - o Annual audits of waste management contractors
 - o Procurement: Purchase products in a manner that minimises waste generation.
- Monitoring, Tracking, and Compliance
 - o Cradle-to-Grave Tracking: An inventory is maintained via Waste Manifest Forms (WMF), recording type, quantity, and fate of waste in a consistent format across all assets.
 - o Performance Assessment: Regular internal inspections and spot checks are conducted to ensure compliance.
 - o Variability Management: The plan acknowledges that waste types and volumes will fluctuate (e.g., during drilling or shutdowns). Contractors are required to have facilities (balance tanks, bunded storage) to handle these fluctuations.
 - o Offshore Discharge: Strictly prohibited unless explicitly authorised by CEPA and permitted by MARPOL.
- Waste Management Centre (WMC) and Classification
 - o WMC Function: A dedicated facility to collect, segregate, and prepare waste containers for transport to Port Moresby. It serves both TEP PNG and contractors.
 - o Classification: All waste is classified as either Hazardous or Non-Hazardous to ensure safe handling. New waste types not currently listed will require a WMP addendum.

Waste Management Procedures and Plans

The Waste MP (2024) defines the various aspects and components of waste management for all activities performed by TEP PNG. The WMP applies to all Company activities in PNG and covers all categories of waste generated, handled, transported, and disposed resulting from TEP PNG's activities (exploration, construction, production, and development), including contractors' activities. The overall purpose of the WMP is to ensure that waste resulting from TEP PNG activities is managed in a way that protects the natural environment, the health and safety of personnel, and the community.

Wastes will be characterised according to composition, source, and type, e.g., hazardous and non-hazardous, and managed in appropriately segregated and bunded areas as required. The Waste MP (2024) identifies anticipated non-hazardous and hazardous wastes and their sub-categories for which preliminary management and disposal options and solutions are proposed.

All waste storage areas will be regularly inspected for integrity issues, emissions and leaks; and all waste generated will be tracked by type and volume including transport to its disposal destination.

Waste management requirements (e.g., waste inventory, segregation, storage, disposal, tracking, recording, third-party responsibilities) will be detailed, for various waste types, e.g., liquid, solid, hazardous and non-hazardous wastes, during detailed engineering, and management plans will be prepared for waste-producing or waste-managing facilities and activities in the Project during construction, including preparatory and early works, operation and decommissioning.

The effective implementation of TEP PNG's WMP will be assisted through thorough documentation, including:

- Waste register
- Waste manifests tracking the cradle-to-grave management of all wastes
- Verification through the issue of 'Final Disposal Certificates' or 'Certificates of Destruction' provided by the facility responsible for final disposal.

Waste Management Measures

To facilitate waste management the following measures are proposed:

- A landfill will be designed and constructed in the vicinity of Road R05 Borrow Pit a short distance north of Herd Base.
- The landfill has been reduced in size in FEED phase to accommodate general non-hazardous waste only, with an estimated capacity of approximately 50,000 m³.
- The Project will seek to engage a specialist waste management company for management of waste generated during construction. This will allow for efficiencies of scale and the collation of waste at a Waste Management Area (near to Herd Base) prior to pre-processing, recycling and export to Port Moresby.
- Waste generated beyond PRL-15, such as along the onshore pipeline or offshore will be transported to Port Moresby for pre-treatment and processing.

TEP PNG will provide logistics for waste management, including transportation (barging of waste) to Port Moresby.

With the exception of food wastes, which will be discharged to sea after shredding; sewage blackwater and sludge, which will receive physico-chemical treatment prior to permitted discharge, and hydrotest water, which may be discharged offshore following reuse where practicable and subject to applicable discharge requirements, all wastes generated offshore will be transferred onshore for management, treatment as required, and recycling or disposal with wastes generated onshore.

The responsible parties identified include TEP PNG, waste disposal contractors, and certified local third-party waste disposal facilities, which, as indicated will be located either in Port Moresby or internationally.

Incinerator

Due to limited existing waste management capacity and the Project's remoteness, it is proposed certain waste types should be incinerated:

- During the early works the project will utilise an industrial incinerator available in Port Moresby until such time as a permanent industrial incinerator is installed at the CPF. The Port Moresby incinerator may be used for 1-2 years after the commencement of construction (to be confirmed).
- During the latter stages of the early works and throughout operation, a suitably sized, purpose-built, high-temperature, industrial incinerator designed to internationally recognised standards.

- EHS Guidelines for Waste Management Facilities (IFC, 2007) will be used to reduce the volume of waste for disposal. The high temperature (870 to 1,200°C) will reduce the risk of emissions associated with incomplete burning of non-hazardous wastes, and the residual ash which is classified as a hazardous waste is disposed of in a licenced landfill.

The incinerator, which will be sited at the general waste management area, and other combustible hazardous materials to reduce waste volumes and will be managed in accordance with IFC requirements.

Additionally, smaller incinerator units may be used at the temporary construction camps for non-hazardous combustibles (e.g., food waste and packaging). Any excess non-hazardous waste from the temporary construction camps will be brought back to the general waste landfill for disposal. All incinerator ash is classified as hazardous and will be disposed of in a licenced landfill.

General Waste Landfills

Landfilling of waste is to be avoided and used as a last option as per the waste management hierarchy. The landfill in PRL-15 shall be constructed in accordance with requirements outlined in Company's general specification for Landfill Design and Operation for E&P Sites (GS EP ENV 421) (Ref. PG-P15-00-PHSE-000032) and will accommodate general non-hazardous waste only, with an estimated capacity of approximately 50,000 m³.

Table 6-33: Mitigation measures - Waste management

Impact	Mitigation code (As in MP)	Description	Source document
Waste generation, storage, and management	EM043	Waste incineration shall: • Use appropriately designed incinerators commensurate with the proposed inventory. • Be considered for waste that will effectively combust. • Be operated to the required specification and by competent personnel.	<i>EIS/ Upstream CESMP; 2019</i>
	ED035	Design Project infrastructure (including workforce accommodation) to minimise vector harborage (e.g., minimise pooling water, proper waste disposal) and human exposure (e.g., screening of doors and windows) to minimise spread of disease.	<i>EIS/ Upstream CESMP; 2019</i>
	ED039	Waste will be managed to reduce, reuse and recycle/recover the waste where practicable. Waste management requirements (e.g., waste inventory, segregation, storage, disposal, tracking, recording) will be detailed during FEED.	<i>EIS/ Upstream CESMP; 2019</i>
	EM008	Sewage effluents from Project facilities will be treated to meet the environment (waste discharge) permit before discharge, in accordance with applicable standards.	<i>EIS/ Upstream CESMP; 2019</i>
Vegetation clearing and spoil disposal	EM030	Dispose of excess spoil material from Project earthworks in designated spoil disposal sites.	<i>EIS/ Upstream CESMP; 2019</i>
Construction and operation of landfills	ED005	The landfill will be designed to comply with TotalEnergies' general specification for landfills, and will be designed, located, constructed and operated in general accordance with the intent of the Code of Practice for Sanitary Landfill Sites (DEC, 2001) and other applicable standard industry practices.	<i>EIS/ Upstream CESMP; 2019</i>
Landform destabilisation due to waste disposal	EM001	All sites proposed for development as part of the Project will be subject to a preconstruction survey to clearly identify acid sulphate soils, sensitive sites and habitats, e.g. roosting, breeding, nesting and threatened species sites, priority ecosystem services, archaeological sites, burial sites, sites of religious importance to be subject to specific mitigation measures.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
	EM002	Progressively clear vegetation and rehabilitate cleared areas as soon as practicable to minimise the time cleared areas are exposed; and allow fauna to move away from areas to be cleared, where practicable.	<i>EIS/ Upstream CESMP; 2019</i>
	EM003	Cut trees where practicable to retain the rootstock and maintain soil stability.	<i>EIS/ Upstream CESMP; 2019</i>
	EM004	Erosion and sediment control measures will be implemented for infrastructure components in accordance with good international industry practice to effectively manage stream and river flows, stormwater, surface erosion, sedimentation and scour, e.g. drainage diversion into surrounding vegetation, rip-rap aprons, rock armoring, energy dissipators, sediment control ponds, mulch berms and sediment fences, where required, until the area has been effectively stabilised and/or rehabilitated.	<i>EIS/ Upstream CESMP; 2019</i>
	EM005	Stabilise spoil stockpiles and areas of ground disturbance as soon as practicable after initial disturbance using, e.g., mulched vegetation, aggregates and soil binders.	<i>EIS/ Upstream CESMP; 2019</i>
	EM006	Areas of higher risk of landslides e.g., steep gradients, previously disturbed land, likely to occur from the works, or likely to be exacerbated by the works, will be stabilised to reduce the landslide risk.	<i>EIS/ Upstream CESMP; 2019</i>
	EM011	Water from trenches will be discharged in accordance with applicable water quality standards with erosion and sediment controls where relevant.	<i>EIS/ Upstream CESMP; 2019</i>
	EM029	Actively or passively rehabilitating bare sites as soon as possible to promote a stable self-sustaining landscape. e.g.: • Allow forest edges to naturally regenerate or create appropriate conditions to facilitate natural regeneration, e.g. rip the substrate, replace topsoil, apply mulch. • Rehabilitate Pandanus habitats, e.g. recreate mounds, re-instate the intertidal surface between Pandanus mounds. • Rip compact surfaces across the slope, as appropriate, to facilitate revegetation and minimise erosion.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		- Spread stockpiled topsoil, organic matter and cleared vegetation over the rehabilitation area to promote natural regeneration. - Use native vegetation to revegetate sites when active rehabilitation measures are required.	
	EM030	Dispose of excess spoil material from Project earthworks in designated spoil disposal sites	<i>EIS/ Upstream CESMP; 2019</i>
Emergency Preparedness	EM018	An Emergency Response Plan will be developed to effectively manage the preparedness and response to emergency events. It will contain: - Site Contingency Plans, that will consider fire management measures - An Oil Spill Contingency Plan, that will consider spill risks for construction, operation and decommissioning of facilities and associated infrastructure, and supply services on land and in aquatic and marine environments. - A Blow Out Contingency Plan including well blowout control and contingency measures.	<i>EIS/ Upstream CESMP; 2019</i>
Community Health	SM014	In areas of high risk of Project-induced in-migration in the PAol, undertake a feasibility assessment in consultation with relevant stakeholders on initiatives aimed at improving water, waste, sanitation and hygiene services (WASH).	<i>EIS/ Upstream CESMP; 2019</i>
Vessel Waste	ED022	Ballast waters, liquid effluents and waste from vessels will be managed according to the MARPOL 73/78 requirements.	<i>EIS/ Upstream CESMP; 2019</i>

Notes: C = construction, O = operations, D = decommissioning

6.9.9 Waste Management Residual Impacts

While residual impacts associated with waste management are not assessed under a dedicated waste topic, relevant impact pathways have been addressed through the soils (see section 6.7.5), hydrology (see section 6.8.5) and hydrogeology (see section 6.8.9) assessment and are concluded to be Minor or Negligible.

6.10 Landscape and Visual Amenity

6.10.1 Introduction

This section presents a synthesis of Project documentation relating to landscape and visual amenity for the Project, focusing on potential changes to the character of the landscape and the visual experience of viewers.

The assessment emphasises Project components likely to result in the main landscape or visual impacts, including the CPF, and associated infrastructure, and elements visible to the public, such as the export pipeline shore crossing at Orokolo Bay. Other components, including wellpads, flowlines, and quarries, are located in remote areas and are generally accessible and visible only to Project personnel within restricted zones; these are therefore excluded from the assessment, Impacts Amenity and Climate Change, (2017).

The assessment draws on relevant documentation, including the EIS Impacts Amenity & Climate Change (2019), and the FEED Changes EAR (2025). Additionally, the EIS Addendum (2024) provided further assessments to account for the relocation of CPF from site P2C to P3.

6.10.2 Baseline

The baseline and assessment were informed by aerial photography, topographic surveys, GIS and satellite data, LiDAR, the Forest Inventory Mapping System, and field observations by specialist teams.

Baseline findings show that the upstream Project area comprises largely undisturbed, dense native vegetation in rugged, flood-prone, and inaccessible terrain. The area is sparsely populated, aside from small subsistence villages along the Purari River and larger Gulf of Papua coastline. Due to dense vegetation, remoteness, and challenging terrain, few locations are likely to experience visual contrast from the existing landscape.

The landscape of PRL-15 is highly varied. Steeply sloped mountainous terrain dominates the northern two-thirds of the area, where wellpads are located, while the southwestern portion comprises alluvial plains of the Purari River basin which are subject to periodic inundation. The CPF, river offloading facilities, camps, roads, and bridges are situated in a hilly area adjacent to the Purari River alluvial plain, with the Purari Airstrip located to the south of the river. The onshore export pipeline traverses approximately 60km of varied terrain, including hilly areas, extensive alluvial plains, steeper hills, and a flat coastal zone of sand dunes and beach ridges at Orokolo Bay. Beaches in this coastal area are regularly interrupted by rivers, coastal lagoons, and inlets.

Existing human activity in the Project area is limited, primarily associated with gas exploration and logging operations. Logging roads are a notable feature, particularly south of the Purari River, where riverside clearance facilitates log landings and machinery movement. PRL-15 is largely unsettled, with only a few small, subsistence-based villages and scattered settlements near the Purari River and along the coastal pipeline route. The closest sensitive receptor is Pokore Hamlet (established in 2019), which has direct views across the Purari River to the CPF site and the associated infrastructure.

6.10.3 Impact Assessment

This section presents the assessment of potential impacts to landscape character and visual amenity arising from construction, operation, and decommissioning of the Project. Impacts are assessed for representative receptors and viewpoints identified in Section 6.10.2 and described in Section 6.10.3. The assessment is based on the baseline landscape and visual amenity study from the EIS (2019), which included a desktop review mapping and describing broad landscape character types within PRL-15. Further characterisation of

the regional and Project area landscape is detailed in Section 10.4 of EIS Vol. 1 Ch. 10: Existing Environment – Amenity (2019) within the EIS (2019).

For the EIS Addendum (2024), a 3D viewshed analysis was conducted using LiDAR-derived elevation data to create a digital elevation model of the topography around the CPF and Purari Airstrip extension. The model included assumed average vegetation height to account for visibility reduction by the existing canopy.

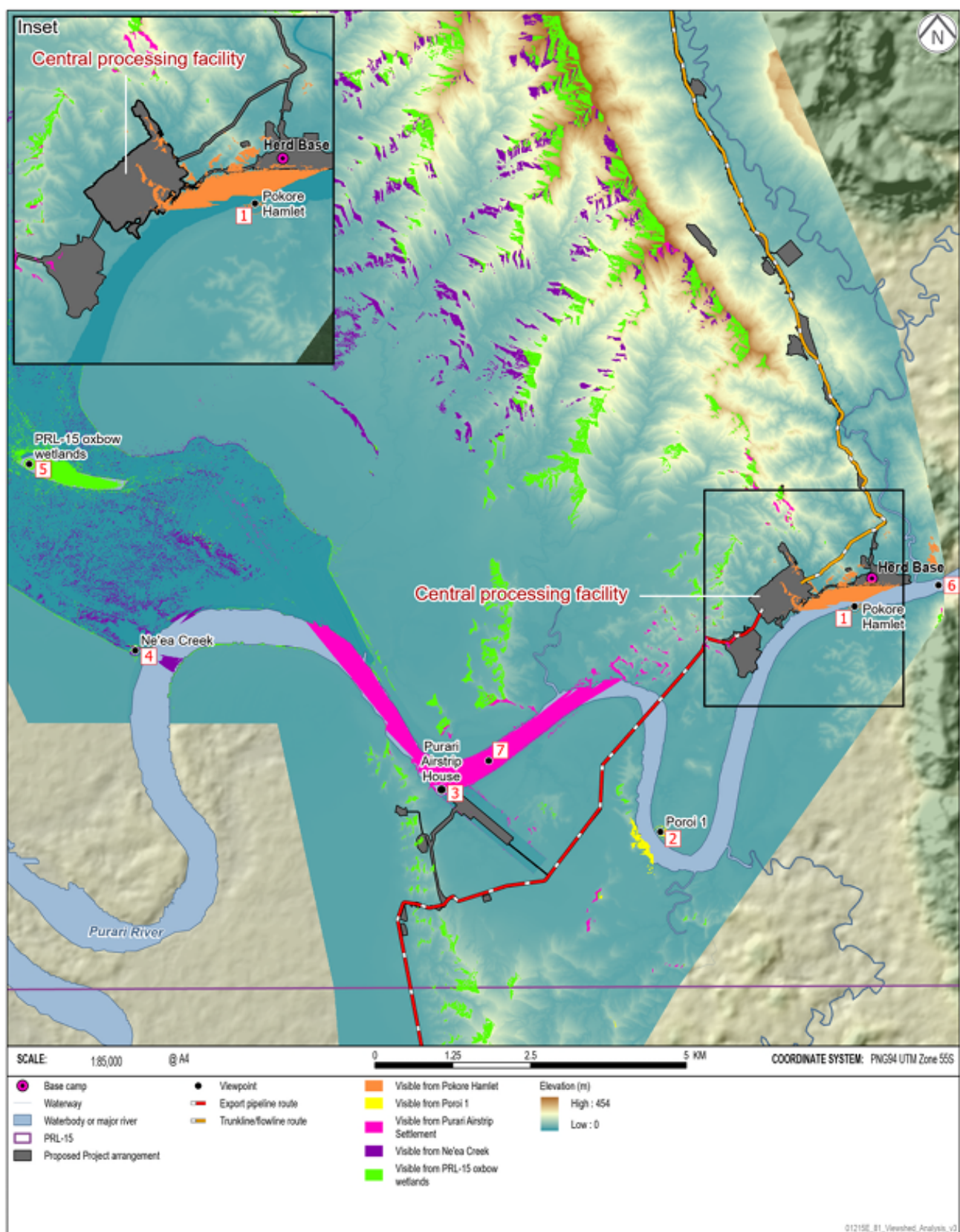
Key Project component dimensions and assumptions were incorporated:

- Heights of the CPF flare and hot water stack are 170 m and 99 m, respectively, measured from sea level and including platforms.
- Buildings at the CPF site are 8 m high above the CPF P3 platform (37 m ASL).
- Purari Airstrip buildings are 4 m high.
- The MOF is 45 m ASL.
- Canopy cover in the onshore Project area is 60–80%, with canopy height included as 20 m.
- Viewer eye level of 1.5 m above ground surface, applied within a 100-m buffer around each land-based receptor.

Table 6-34: Description of viewpoints assessed for landscape and visual impact - Source: EIS Addendum (2024).

Location	Description
Places of habitation near the CPF	• Poroi 1 (Viewpoint 2) and Ne’ea Creek (Viewpoint 4) are approximately 3.1 km to the south and 9.2 km to the west of the CPF, respectively, on the northern banks of the Purari River. • Pokore Hamlet (Viewpoint 1) and the Purari Airstrip House (Viewpoint 3) are approximately 0.3 km southeast and 5.2 km southwest of the CPF, respectively, on the southern bank of the Purari River. • High sensitivity for Pokore Hamlet (Viewpoint 1) (Views are experienced over several hours by the local community, i.e., direct view to CPF, but the CPF is not where people’s attention is focused as they undertake their daily activities). • Low sensitivity for Viewpoints 2, 3 and 4 (less than 500 people per day; only used by people from local communities; views are temporary; high use for primary subsistence activities).
PRL-15 oxbow wetlands	The PRL-15 oxbow wetlands (Viewpoint 5) are approximately 11 km west northwest of the CPF and 2.5 km north of Ne’ea Creek (formerly Mapaio Fish Camp; see Figure 6-9) • The wetlands are accessed by local communities year-round for subsistence collection of natural resources and for cultural reasons. • Minimal sensitivity (area with no permanent settlement accessed rarely by people from local communities).
River transport	The Purari River is used for transport daily by both the community and commercial operators. Purari River upstream from Herd Base (Viewpoint 6) and Purari River upstream from Purari Airstrip House (Viewpoint 7) were assessed. • Low sensitivity (riverways have daily but often transient use mostly less than 500 people per day, predominantly from local communities; daily use for primary subsistence activities).

Figure 6-9 shows the viewshed analysis from village viewpoints. Current views from each receptor indicates that the most expansive views are from Ne'ea Creek and the PRL-15 oxbow wetlands. In comparison there are more restricted views from Poroi 1 and Pokore Hamlet. Views from the Purari Airstrip House are mostly constrained to along the Purari River. This analysis is based on a canopy height from LiDAR data, 20-m vegetation height elsewhere, viewer eye level of 1.5 m, clearance footprint and elevation based on LiDAR, hence this is a conservative assessment.



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Figure 6-9: Viewshed analysis from villages and static viewpoints. (Source: EIS Addendum (2024). Note: The Project footprint has undergone changes since 2024, and no longer includes Quarry C/D.)

Construction

The construction of CPF facilities and associated infrastructure, some of which will be temporary in nature, may change, reduce or result in a loss of existing visual amenity or landscape character for viewers from representative viewpoints.

Temporary construction areas, such as laydown zones, camps, storage yards, workshops, and material extraction sites, will expand the Project footprint and progressively increase visual impacts during construction. New industrial elements and earthworks will alter the natural landscape, although dense vegetation and rugged terrain will provide some screening.

Most villages and transport routes are distant from the onshore export pipeline and will experience limited visual impacts. However, communities near Orokolo Bay will experience reduced visual amenity during pipeline construction and shore crossing works. Vegetation will partially regenerate following rehabilitation; however, the permanently lowered vegetation height along the right of way will create a lasting change to landscape character.

Along the onshore pipeline route, temporary visual impacts will result from vegetation clearing, earthworks, and the presence of construction machinery. Aivai village will experience short-term visual impacts from the nearby pipe yard and construction camp during the construction phase.

Operation

During operations, long-term Project footprints, including wellpads, the CPF, pipeline rights-of-way, access roads, the upgraded Purari Airstrip, and associated facilities, will continue to alter landscape character over the approximately 25-year operational period.

As the more distant villages of Poroi 2, Subu 1, Subu 2 and Wabo will not be able to see the CPF and associated infrastructure, they have been excluded from the assessment.

The CPF flare and MOF will be the most visible aspects, while facilities such as the COF and ramp will be less visible due to their lower profiles. Shorter Project components, such as CPF buildings, may theoretically be visible for distances of 5 km or more, while the flare and hot water stack could potentially be visible above the tree line for distances of 10–12 km or more. In practice, dense vegetation and topography will substantially reduce actual visibility.

Given the location of the Project and the screening effects of the surrounding environment, visual exposure will be limited to a small number of receptors, primarily Pokore Hamlet, Ne'ea Creek, the Purari Airstrip House, users of the Purari River, and users of the PRL-15 oxbow wetlands.

Table 6-35: Assessment of visibility of Project elements (Source: EIS Addendum (2024).)

Figure Viewpoint	Ability to View Project Features				
	CPF Flare	CPF Hot water stack	CPF Buildings	MOF	COF
1. Pokore Hamlet	Yes	Yes	No	Yes	Yes
2. Poroi 1	No	No	No	No	No
3. Purari Airstrip House	Yes	Yes	No	No	No
4. Ne'ea Creek	Yes	Yes	No	No	No
5. PRL-15 oxbow wetlands	Yes	No	No	No	No
6. Purari River upstream from Herd Base	Yes	Yes	No	Yes	Yes

Figure Viewpoint	Ability to View Project Features				
	CPF Flare	CPF Hot water stack	CPF Buildings	MOF	COF
7. Purari River upstream from Purari Airstrip House	Yes	No	No	No	No

The CPF and associated infrastructure have the potential to result in:

- A decline, loss of or change to existing visual amenity or landscape character, including illumination from night lighting, for receptors at the Purari Airstrip House, Ne'ea Creek and Pokore Hamlet.
- A decline or change to existing visual amenity or landscape character for people using the PRL-15 oxbow wetlands for fishing, hunting or cultural activities.
- A decline or change to visual amenity for river users near the CPF, COF and MOF.

Viewers at Poroi 1 will not be able to see any Project features; therefore, impacts to this village have not been assessed.

Places of Habitation

Places of habitation near the CPF site have been assigned a Low sensitivity rating, with the exception of Pokore Hamlet, which has been assigned a High sensitivity rating.

- **Ne'ea Creek and Purari Airstrip House**
Viewers may be able to see some Project components in PRL-15. Dense vegetation, elevated topographical features and the meandering Purari River will help to conceal views. The flare and hot water stack will be the most visible components; however, due to distance and their slender appearance, the magnitude of change is assessed as Low, resulting in a Minor impact.
- **Pokore Hamlet**
Pokore Hamlet has direct views across the Purari River to the CPF site. During construction, dust plumes are likely to be visible during dry weather. During operations, residents will be able to see the flare, hot water stack, MOF and COF at distances of approximately 800 m to 1.5 km. The lower-level CPF buildings will not be visible due to vegetation screening. These views occupy approximately 55° of the field of vision. The magnitude of change is assessed as High, resulting in a Major impact significance.

PRL-15 Oxbow Wetlands

Individuals using the PRL-15 oxbow wetlands may see part of the flare at a distance of approximately 12 km. Other Project components will not be visible due to terrain screening. Although the flare represents a permanent change, it is slender in profile and occupies a narrow part of the field of view. The magnitude of change is assessed as Low, and given the Minimal sensitivity of receptors, the impact significance is Negligible.

Purari River Users

A Low sensitivity rating has been assigned to river users, as views are temporary and the number of users is limited. While there is an approximate 7 km stretch of river from which the flare, hot water stack and MOF may be visible, views are transient. The magnitude of change is assessed as Low, resulting in a Minor impact.

Lighting Impacts

Operations at the CPF will be undertaken 24 hours a day, requiring night-time lighting for safety and security. The MOF and COF are primarily day-use facilities. There is potential for direct lighting impacts at Pokore

Hamlet due to proximity; however, Pokore Hamlet was established opposite Herd Base, which already has night lighting. Lighting at the COF and MOF will be similar in nature and at a greater distance.

Lighting requirements for the Project components are yet to be finalised. Night operations are not currently planned for the Purari Airstrip, and as such, any lighting will be restricted to security or safety lighting. The Logistics Base and Purari Airstrip may be visible from the Purari Airstrip House during both the night and the day, depending upon the final lighting design for these two facilities; however, as the airstrip will not be used for night flights and the Logistics Base is primarily a day use operational area, substantial night-lighting is not anticipated to be required and is not expected to adversely affect local inhabitants (EIS, 2019).

Indirect lighting effects (sky glow) may occur, although substantial topographic features and dense vegetation will restrict views. Lighting impacts are summarised below.

Table 6-36: Assessment of lighting impacts (Source: EIS Addendum (2024))

Receptor	Sensitivity	Magnitude	Significance
1. Pokore Hamlet	High	Low	Moderate
3. Purari Airstrip House	Low	Minimal	Negligible
4. Ne'ea Creek	Low	Minimal	Negligible

Gas Flaring

Gas flaring from the CPF will be required occasionally during start-up, maintenance and upset conditions. The 170-m tall, high-pressure flare stack may be seen from all sensitive viewpoints except Poroi 1. If flaring is required at night, the flare may reduce visual amenity at these locations due to the brightness and apparent movement of the flame, but this would decrease with increasing distance from the flare. Upset condition flaring is rare, temporary and would not adversely affect residents of the Pokore Hamlet, Ne'ea Creek, Purari Airstrip House. Hence the magnitude of impact would be Minimal.

In addition to flaring, aircraft warning lights on the flare stack will be visible, though more so at night. Given the nature of these lights (i.e., height, directionality, purpose), these are not expected to adversely affect residents of Pokore Hamlet, Ne'ea Creek, Purari Airstrip House.

Decommissioning/closure

While neither the EIS (2019) nor EIS Addendum (2024) presents an assessment of the impacts during the decommissioning phase, the following have been described.

There is potential for a decline, loss of or change to visual amenity. The following locations may continue to be visually impacted:

- Pokore Hamlet
- Purari Airstrip House and Ne'ea Creek
- PRL-15 oxbow wetlands
- Users of the Purari River near the CPF, COF and MOF.

The full extent of these impacts will be addressed during detailed decommissioning planning.

6.10.4 Mitigation

Mitigations described here and seen in Table 6-37 portray the proposed mitigation and management measures to further reduce adverse effects on landscape and visual amenity.

For visual amenity impacts, including night lighting near the Purari Airstrip House:

- Minimise and carefully direct night lighting to avoid illuminating the airstrip house and surrounding forest, using only the lighting required for safe operations [EM047].

For broader landscape and visual impacts:

- Rehabilitate disturbed areas as early as possible to create stable, self-sustaining landscapes. This includes enabling natural forest edge regeneration, restoring Pandanus habitats, ripping compacted ground, and applying topsoil, mulch, and organic material to promote regrowth, using native species where active planting is needed [EM029].
- Retain vegetation buffers wherever practicable to help screen facilities and reduce visual exposure [EM048].

As per the EIS Addendum (2024), potential physical resettlement of Pokore Hamlet [SM031] is pending further noise assessments and further engagement with the affected households. Should physical displacement be necessary, the Project will follow IFC PS5 Land Acquisition and Involuntary Resettlement and obtain FPIC from both affected households and, where relevant, host communities in accordance with IFC PS7 on Indigenous Peoples. A visual impact assessment will be included in the process of host community-selection [EM052].

Table 6-37: Mitigation measures - Landscape and visual amenity

Impact	Mitigation code (As in MP)	Description	Source document
Landscape and visual amenity	EM047	Avoid directly lighting areas at night and minimise fixed night lighting for safe operations, e.g., direct lighting away from the Purari Airstrip House, and the surrounding forest.	<i>EIS/ Upstream CESMP; 2019</i>
	EM052	A visual assessment will be included in the site selection process for resettling Pokore Hamlet.	<i>EIS Addendum; 2024</i>
	EM029	Actively or passively rehabilitating bare sites as soon as possible to promote a stable self-sustaining landscape. e.g.: • Allow forest edges to naturally regenerate or create appropriate conditions to facilitate natural regeneration, e.g. rip the substrate, replace topsoil, apply mulch. • Rehabilitate Pandanus habitats, e.g. recreate mounds, re-instate the intertidal surface between Pandanus mounds. • Rip compact surfaces across the slope, as appropriate, to facilitate revegetation and minimise erosion. • Spread stockpiled topsoil, organic matter and cleared vegetation over the rehabilitation area to promote natural regeneration. • Use native vegetation to revegetate sites when active rehabilitation measures are required.	<i>EIS/ Upstream CESMP; 2019</i>
	EM048	Where practicable, retain a vegetation buffer to screen infrastructure and facilities.	<i>EIS/ Upstream CESMP; 2019</i>
Resettlement	SM031	Resettlement of Pokore Hamlet according to a Resettlement Action Plan (RAP) to be developed and assess social impacts associated with the new location.	<i>EIS Addendum; 2024</i>

6.10.5 Residual Impacts

The residual visual impacts of the Project are assessed as Minor or Negligible for all receptors following the implementation of mitigation and management measures. This reflects the isolated nature of facilities and low population density combined with thick vegetation coverage. The table below includes the potential for resettlement of Pokore Hamlet (mitigation measure SM031) and a visual impact assessment will be included in the process of site selection (mitigation measure EM052). However, the residual landscape and visual amenity impacts to the residents of Pokore Hamlet may remain moderate pending further noise assessment.

Table 6-38 below describes the significance of residual impacts following mitigation and management measures as seen in the EIS Addendum (2024).

Table 6-38: Summary of potential residual impacts - Landscape and visual amenity (Source: EIS Addendum (2024))

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual Impact Assessment	
						Sensitivity/Magnitude	Significance
Pokore Hamlet	Gas flaring. Vegetation clearing. Earthworks. Construction works (CPF and flare, COF, MOF). CPF operations. Logistics and transport.	Decline, loss of or change to existing visual amenity or landscape character.	PRL-15	C,O,D	EM052 SM031	High/Minimal	Minor
Purari Airstrip House , Ne'ea Creek	Gas flaring. Vegetation clearing. Earthworks. Construction works (CPF and flare, COF, MOF). CPF operations. Logistics and transport.	Decline, loss of or change to existing visual amenity or landscape character.	PRL-15	C, O, D	None	Low/Low	Minor
PRL-15 oxbow wetlands	Vegetation clearing. Gas flaring.	Decline, loss of or change to existing visual amenity, landscape character or connectivity.	PRL-15	C, O, D	None	Minimal/Low	Negligible
Users of the Purari River CPF, COF and MOF	Gas flaring. Vegetation clearing. Earthworks. Construction works (CPF, COF and MOF). CPF operations. Logistics and transport.	Decline, loss of or change to existing visual amenity.	PRL-15	C, O, D	EM029 EM048	Low/Medium	Minor
Villages – Pokore Hamlet	Project facilities lighting emissions.	Illumination from night lighting, which may reduce visual amenity for residents.	PRL-15	O	EM029 EM048 EM047	High/ Minimal	Minor
Villages – Purari Airstrip House and Ne'ea Creek	Project facilities lighting emissions.	Illumination from night lighting, which may reduce visual amenity for residents.	PRL-15	O	EM047	Low/Minimal	Negligible

6.11 Physical Marine Environment

6.11.1 Introduction

This section contains a summary of the baseline, impact assessment, and mitigation measures proposed by Project documentation for physical aspects of the marine environment. The marine environment within the PAoI covers Orokolo Bay, the condensate pipeline route to the FSO facility, the gas export pipeline route to Caution Bay, and Caution Bay itself. For details on this route and the extent of the marine area within the PAoI, refer to Section 3: Project Description.

This section presents the assessments undertaken for physical marine aspects within the EIS (2019), and subsequent supporting documents, which collectively cover the relevant scope for physical marine processes. The following physical environment topics are included:

- Bathymetry
- Wind direction and prevalence
- Tides and currents, directions and current speed
- Wave climate – direction significant wave height and wave period
- Sediment type, areas of hard substrata, particle size analysis data, contamination
- Coastal processes, sediment transport, erosion and deposition
- Marine water quality, salinity, temperature turbidity, contamination.

For baseline, impact and mitigation measures relating to marine biodiversity, refer to Section 6.18 (Marine Biodiversity).

6.11.2 Baseline

This summary consolidates baseline data collected across multiple campaigns (2016–2017, 2023, and 2025 where available) into a single, location-based overview: Orokolo Bay, Offshore Corridor, Caution Bay, and Borrow Area (an area southeast of Orokolo Bay). It focuses on water quality, sediment quality, and key physical processes. Where the most recent data are from earlier campaigns, this is indicated.

This summary draws on baseline marine surveys conducted for the EIS, in 2016–2017 (dry season: 20 June–9 July 2016; wet season: 12–31 January 2017) (henceforth, EIS Marine ESBS (2016–2017)), Marine Environmental Baseline Study (2024) fieldwork from 26 September–12 October 2023 (henceforth, Marine EBS (2024)) and verification sampling along the Kutubu Export Pipeline Route and PLEM anchors in 2025 (henceforth, Additional Offshore Marine Sampling (2025)).

In preparation of the EIS (2019), regional syntheses were also conducted for the marine physical environmental, drawing on existing studies and scientific literature (henceforth, referred to as Regional Syntheses (2019)).

Methods and Standards

- Multiple field campaigns included in situ profiling, discrete water sampling (surface/mid/bottom), sediment sampling, and deployed loggers (turbidity, conductivity, temperature, depth). Acoustic mapping and ground truthing supported habitat characterisation.

- Assessments referenced ANZECC/ARMCANZ (2000) and subsequent revisions for water & interim sediment guidelines; the EIS (2019) framework; and for 2023 surveys, PNG Environment Regulation Schedule 1 and selected EU/US benchmarks were used for comparison.

See Figure 6-10 below for the extent of the marine physical environment.

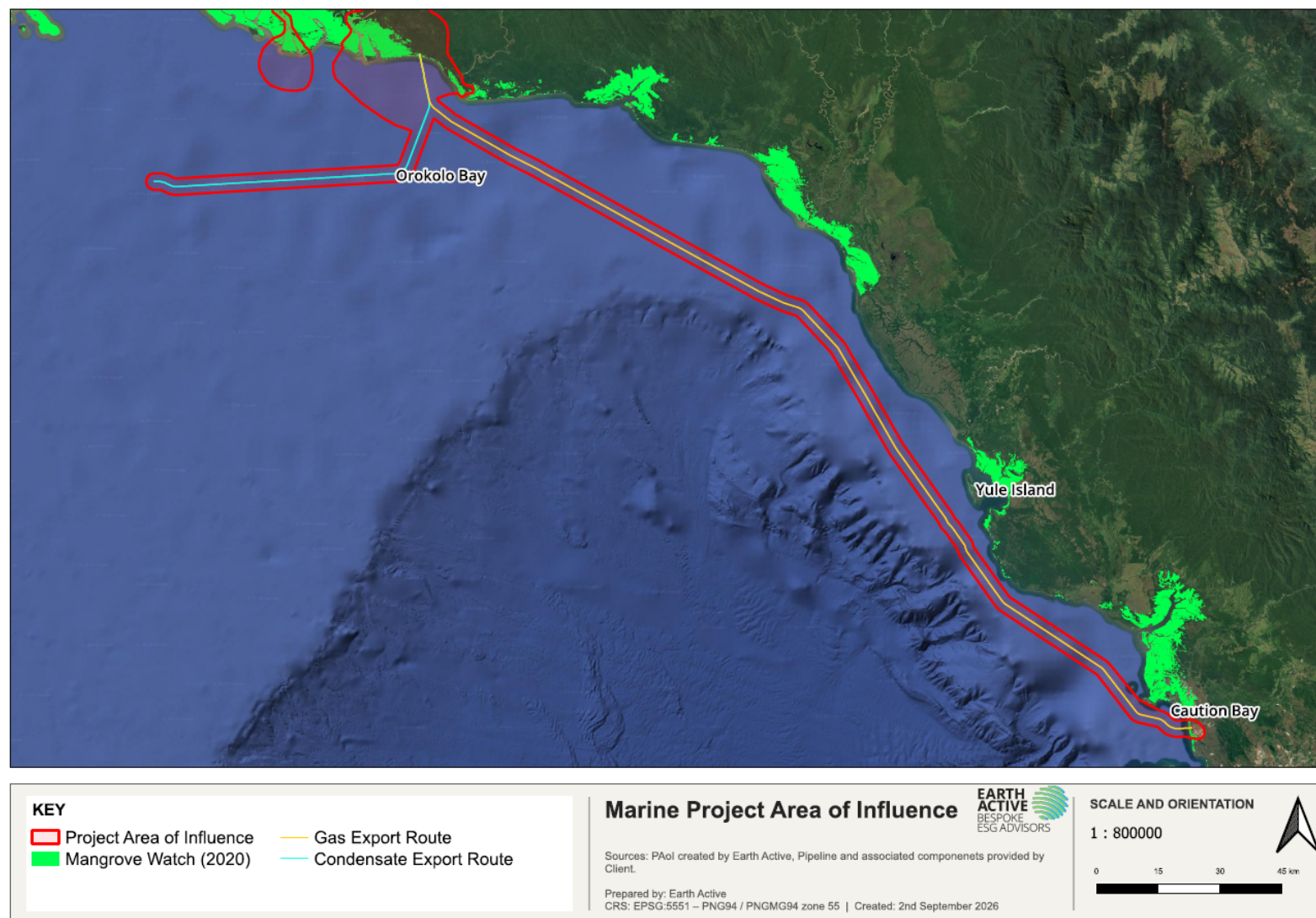


Figure 6-10: Physical marine environment

(Source: Marine EBS, 2024) Note: Project footprint changes have been undertaken since production of this map and therefore the condensate pipeline is not featured in this

Regional Physical Setting

The following regional dynamics are provided as they are important context for seasonal turbidity, sediment resuspension, and surface freshening observed in Project locations:

- **Bathymetry:** Much of the Gulf of Papua is shallower than ~100 m to ~200 km offshore; the shelf edge drops to ~2,000 m. Shallower eastern shelf edge leads to rapid deepening within ~50 km of shore.
- **Winds/Waves:** Two seasons dominate: Northwest (NW) monsoon (Dec–Mar) with calmer conditions; southeast trade winds (May–Oct) with stronger winds and higher wave driven resuspension, peaking around July. Trade winds season drives higher turbidity via wave induced resuspension, particularly in Orokolo Bay. Caution Bay is more sheltered with lower TSS relative to Orokolo.
- **Tides/Currents:** Semi diurnal tides (typical ~1 m neap, ~3 m spring locally; up to >5 m near Fly River in the west); seasonal circulation with an anticlockwise shelf pattern during monsoon and northwest-ward flows under trade winds.
- **Freshwater Influence:** Large river inputs (Fly, Bamu, Turama, Kikori, Purari) shape salinity and turbidity; a surface low salinity lens (halocline) commonly extends tens of kilometers offshore.
- **Substrates:** Substrates across the corridor and bays are predominantly fine grained (silts/clays) with patchy sands (e.g., plume proximal or near Yule Island); this influences metal partitioning (finer sediments tend to host higher metal concentrations).

Orokolo Bay – Baseline Results

The following baseline information has been gathered for Orokolo Bay. Generally for Orokolo Bay, strong river influence drives surface freshening, turbidity, and trace metal patterns near the plume. Sediments are fine grained with terrestrial signatures; hydrocarbons remain low.

- **Water Column** (Most recent data: Marine EBS (2024), supplemented by EIS Marine ESBS (2016–17))
 - o A strong river–sea salinity gradient is routinely observed at the surface due to the Purari River plume, with surface freshening and halocline formation near the interface. Associated signatures include elevated orthophosphate, TOC, suspended matter, and higher Ba, Mn, Cu, V, with the highest risk indicators in Fe, Pb, Al relative to referenced benchmarks.
 - o PAHs are generally low; however, dibenzo[a,h]anthracene and indeno[1,2,3 cd]pyrene slightly exceeded reference values at some stations, and benzo(g,h,i)perylene exceeded one EQS at a station—localised to plume influenced settings.
 - o Earlier (2016–17) surveys reported >80–90% DO saturation and low nutrients (chlorophyll a mostly <1 µg/L), with metals mostly below detection or low; isolated, marginal exceedances for Cu (dry season) and dissolved Hg (wet season) at single sites were near reporting limits. These remain the latest detailed multi season DO/chl a contextual data for the area.
- **Sediment** (Most recent data: Marine EBS (2024); supplemented by Regional Syntheses (2019))
 - o Superficial sediments are mainly silty/fine mud, with plant debris widely present—consistent with terrestrial inputs from the Purari River. Near plume proximal station within study area, fine sand occurs. Organic enrichment is low in coastal stations and average at deeper stations.
 - o Regional syntheses (2019) noted naturally elevated nickel in some sediments and hydrocarbons below reporting limits—findings that remain consistent with recent observations.

- Copper/mercury one off exceedances at Orokolo Bay in the EIS Marine ESBS (2016–2017) were just above reporting limits, highlighting analytical variability at low concentrations; these remain isolated observations.

Offshore Gas Corridor – Baseline Results

The following baseline information has been gathered for the Offshore Corridor:

- Water Column (Most recent data: Marine EBS (2024); earlier seasonal context from EIS Marine ESBS (2016–17)
 - o A surface freshening gradient (desalination trend) is observed moving southeast-ward with diminishing effect—i.e., a salinity gradient consistent with plume influence decaying offshore. Trace metals in surface waters were below quantification limits except Mo; PAHs were very low and below EQS values.
 - o Earlier (2016–17) datasets indicated generally low nutrients, chlorophyll a mostly <1 µg/L, and metals/metalloids mostly below detection; hydrocarbons (PAHs/TPH/BTEX) were below reporting limits across seasons—useful context where 2023 coverage was constrained by sea state.
- Sediment (Most recent data Marine EBS (2024); supplemented by Regional Syntheses (2019) baseline synthesis)
 - o Sediments are heterogeneous: predominantly silty mud/very fine mud/silty clay, with local patches of sandy mud/silty sand. No marked stratification; temperatures ~23.4–24.7 °C. Most stations show average organic enrichment.
 - o Regional syntheses (2019) reported predominantly fine-grained depositional substrates along the offshore route (35–60 m depth) where waves rarely mobilise the bed—this remains the latest process-based context for sediment stability.
- Spatially Localised Metal Signals (Most recent data: Marine EBS (2024))
 - o Potentially elevated trace metal indicators were noted near Yule Island (Hg, Cu, As) and south of Yule Island (Hg). West of Yule Island and near Caution Bay, Ni indicators were relatively lower compared to a generalised corridor wide Ni signal. These are screening level observations, not tiered risk assessments.

Caution Bay – Baseline Results

The following baseline data has been gathered for the Caution Bay area. Generally, Caution Bay can be described as a well-mixed system with low nutrients, higher TOC/Suspended solids, and some elevated metal indicators in recent screening; historical datasets indicate good DO and generally low contaminants.

- Water Column (Most recent data: Marine EBS (2024), with results from EIS Marine ESBS (2016–17) for seasonal comparison)
 - o Low inorganic nutrients, higher TOC and suspended matter were reported; no surface freshening signal (consistent with well mixed water column and limited river influence). Screening indicated elevated As, with Mo, Pb, Zn also higher— interpreted as potential indicators possibly linked to small local catchments or land use, not confirmed contamination.
 - o Earlier multi season data (2016–17) showed lower turbidity/TSS than Orokolo and high DO (>90% saturation), with nutrients, metals, hydrocarbons generally low and within guidelines—this remains the most complete seasonal comparison for the site.

- Sediment (Most recent data: Marine EBS (2024); consistent with Regional Syntheses (2019))
 - o Superficial sediments: mainly silty mud, no marked stratification. Average organic enrichment at most stations.

Offshore Condensate Corridor – Baseline Results

- 2025 targeted sampling along the Kutubu Export Pipeline Route and PLEM anchors reported metals in water mostly below detection (exception: boron detectable) and sediment metals below guidelines except naturally elevated Ni; hydrocarbons below reporting limits. These results corroborate prior findings of generally low hydrocarbons and background type metal patterns with localised exceptions.

6.11.3 Impact Assessment

The principal source of impacts on the physical marine environment will be due to the:

- Impacts on coastal processes due to physical presence of marine structures. This has the potential for main impacts to occur at the Orokelo Beach crossing where a cofferdam structure may be required to prevent infilling of the trench in the near shore area. It is noted that FEED changes have seen the cofferdam reduced from 800 m to 100 m reducing the potential significance of associated impacts.
- Impacts on water quality (turbidity) from pipeline construction and trenching. Trenching for nearshore pipeline installation will mobilise sediment through the following processes:
 - o Direct physical disturbance of the seabed by the dredging equipment.
 - o Discharge of sediment-laden overflow from the dredge, if a cutter suction dredge is used.
 - o Sediments disturbed by trenching and overflow will be transported by waves and currents and will eventually settle onto the seafloor. Sediment deposited as a result of this process may be available for subsequent resuspension by currents and waves.
- Disposal of drilling fluids from HDD (Caution Bay).
 - o Occurrence of a 'frac out' during HDD may potentially result in drilling fluids reporting to the seafloor in Caution Bay thereby contaminating bottom sediment and seawater. A small amount of drilling fluids may also be expected to discharge to Caution Bay when the HDD reaches its exit point in the seafloor.
- Discharge of hydrotest waters. Treated marine water that will be used for hydrotesting include additives (e.g., oxygen scavengers and biocides, dyes, corrosion inhibitors). Hydrotest water will be reused where possible hence the volume of water required may be less than currently expected. Discharge volumes have also been significantly reduced as a result of changes to the length and diameter of offshore piping.
- Physical disturbance as a result of marine construction vessels.
- Sewage, ballast and bilge water discharge from project vessels.

The following separately summarises the Project impact assessment for Caution Bay and Orokelo Bay shore crossings and the gas and condensate pipelines.

Caution Bay Shore Crossing - Impacts

Changes in morphological processes are not predicted as the pipeline shore crossing will be constructed by HDD rather than sheet piling. The offshore pipeline will be buried (see Section 3.1.1) except for the shipping lane in Caution Bay where a depth of 2.5 m will be maintained. Therefore, there will be no net change to

seabed levels and hence no change to hydrodynamic and morphological processes. The burial depth is also sufficient so that scour will not expose pipelines.

The level of sediment disturbance for HDD is much less than for open trenching. The modelling conducted for the EIS (2019) indicated that assuming open trenching, turbidity levels will be acceptable, so with the reduced potential for turbidity generation with HDD adverse impacts are less likely. The burial depth is also sufficient so that scour will not expose pipelines.

The drilling fluids lost to bottom waters in Caution Bay upon drilling reaching the HDD exit point will be of small volume, with drilling having reached completion. Drilling will be undertaken using water-based muds that have low toxicity and are biodegradable. The area of impact to the water column (and seafloor sediment) from drilling fluids would be very localised (e.g., less than 500 m), short-term (days to weeks) and existing environmental values expected to be maintained.

The impacts associated with the presence the jack-up barge and support barge at Caution Bay are considered in the following section on impacts due to the gas and condensate pipeline construction below.

Orokolo Bay Shore Crossing – Impacts

Installation of the nearshore pipeline will involve construction of a short coffer dam, limited trenching nearshore, and post-trenching offshore, which may temporarily disturb seabed sediments and increase turbidity in Orokolo Bay. The revised 2025 methodology substantially reduces marine physical impacts by shortening the coffer dam (800 m to 100 m), reducing dredging volumes (~1.8 million m³ to ~335,000 m³), and limiting conventional trenching to approximately 0.1 km. Construction duration is also reduced from about six months to three months, further limiting the spatial extent and duration of seabed disturbance.

Gas and Condensate Pipelines - Impacts

The offshore pipelines will be buried only at the shoreline crossings, with the remaining offshore sections laid directly on the seabed (see Section 3.1). Following installation, there will be no net change to seabed levels or to hydrodynamic and morphological processes. The burial depth is also sufficient so that scour will not expose pipelines. Based on the EIS (2019) modelling, the extent of sediment deposition above 200 mg/cm² is predicted to be limited to within 500 m of the trenching for both pipeline alignments. Within 500 m of trenching activities, sedimentation rates are predicted to reach a peak of over 15,000 mg/cm² for both alignments in both seasons. As wave action naturally and rapidly reworks sediment, these modelled peak deposition rates are considered conservative, with the associated volume of sediment spread across a wider area within the deposition extent. Outside of this higher impact area, the sedimentation rates rapidly attenuate to below 200 mg/cm². Wave action will rework and redistribute the deposited sediment. Environmental values would be supported in a slightly to moderately modified condition.

Construction Vessels - Impacts

During construction, vessels to be used by the Project include:

- Barges, which will be used to transport construction equipment, large plant and supplies to PRL-15 via the Gulf, and the Purari River and its distributaries. The highest barge traffic numbers will occur during the construction phase.
- Pipelaying and support vessels, which will operate along the entire offshore export pipeline route.
- Trenching and support vessels, which will operate in waters up to -20 m LAT in Orokolo Bay, and transiting to and from these areas.
- Dredges and associated barges, used for Purari River mouth dredging and offshore disposal operations. Dredging vehicles and activities are described further above.

Propeller wash, anchoring and wake from these vessels can disturb the seabed and shoreline. Considering the environment and depths in which most work will occur, propeller wash and vessel wake are unlikely to cause any significant disturbance. The pipelaying vessel may cause some wash impacts, i.e., displacement of bed sediment, in the pipelaying footprint, however these are predicted to be negligible compared to disturbance associated with the pipe trenching. Seabed disturbance from anchoring will also be minimal as the pipelaying vessel and pipe support vessel will use a dynamic positioning system (i.e., using propellers and thrusters rather than anchors) and the anchoring from other support vessels will be limited, occurring infrequently, being extremely localised and of negligible magnitude. Therefore, impacts of vessel use on sedimentation and physical processes are not considered further.

Project vessels will discharge ballast waters, domestic wastewaters (i.e., sewage and grey water) and bilge waters in accordance with MARPOL requirements.

Hydrotesting - Impacts

Pipeline hydrotesting will be undertaken to confirm the weld integrity following pipeline installation. Hydrotest water will contain a small amount of an oxygen scavenger, such as sodium bisulfite, to inhibit corrosion, and a biocide to prevent bacteria developing. As described in Section 0., the 2025 FEED design changes have resulted in a reduction in pipeline lengths and diameters, which has therefore reduced hydrotest water needs.

Operational Phase - Impacts

The impacts on physical marine environment will be mainly confined to construction phase. No significant impacts are anticipated during operations.

Decommission / Closure Phase - Impacts

The impacts during decommissioning and closure will be similar to, but of a lesser magnitude, than those predicted during construction.

6.11.4 Mitigation

Table 6-39 describes mitigation measures based upon Project activities related to:

- Marine Physical and Sediment Processes
- Marine Water Quality

Table 6-39: Mitigation measures - Physical marine environment

Impact	Mitigation code	Description	Source document
Sediment mobilisation from trenching causing an increase in suspended sediment in the water column and sedimentation on the seabed	EM037	Where required, implement adaptive management to minimise dredging impacts on sensitive habitats and species.	<i>Water Management Plan</i>
	ED041	The offshore pipelines will be buried with 1-m cover depth to the top when located in water shallower than 20 m.	<i>EIS/ Upstream CESMP; 2019</i>
Deterioration in marine water quality due to planned wastewater discharges	EM015	Hydrotest water management will consider: • The definition of volume and discharge rates and discharge locations. • Chemicals additives selection, according to requirements defined in embedded design controls. • Reusing hydrotest water to minimise the discharge volume. • Reducing the need for chemicals by minimising the time hydrotest water remains in the pipeline. • Monitoring hydrotest water discharges to the environment against applicable limits.	<i>EIS/ Upstream CESMP; 2019</i>
Deterioration in marine water quality due to accidental releases of hydrocarbons and chemicals	EM018	An emergency response plan will be developed to effectively manage the preparedness and response to emergency events. It will contain: • Site contingency plans, that will consider fire management measures. • An oil spill contingency plan, that will consider spill risks for construction, of facilities and associated infrastructure, and supply services on land and in aquatic and marine environments. • A blow out contingency plan including well blowout control and contingency measures.	<i>EIS/ Upstream CESMP; 2019</i>
	EM019	Vessels will be required to have shipboard Oil Pollution Emergency Plans/Oil Spill Contingency Plans as per TotalEnergies requirements and the Marine Pollution (Ships and Installations) Act 2013	<i>EIS/ Upstream CESMP; 2019</i>
Contaminant releases	EM008	Sewage effluents from Project facilities will be treated to meet the environment (waste discharge) permit before discharge, in accordance with applicable standards.	<i>EIS/ Upstream CESMP; 2019.</i>
Hydrotesting	ED006	Minimise chemical use and select chemicals considering the following criteria: • Lowest toxicity, lowest bioaccumulation potential and highest biodegradation.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code	Description	Source document
		Chemicals subject to bans or phase-outs.	
Vessels effluent	ED022	Ballast waters, liquid effluents and waste from vessels will be managed according to MARPOL 73/78 requirements.	<i>EIS/ Upstream CESMP; 2019</i>
Drilling Fluids and Drilled Cuttings	TBC	For Caution Bay shore crossing by HDD, additional mitigation measures have been identified. Specifically, the risk of occurrence of frac outs during HDD will be minimised by: - Conducting detailed geotechnical investigations to understand ground conditions along bore path to inform assessment of the risk of frac out and avoid paths in weak zones. - Installing casing at the entry point where reduced cover and bearing pressure exists. - Continual monitoring of drilling fluid pressures and losses during drilling and if unexpected variations or trends are observed cease drilling, investigate causes and implement remedial measures.	<i>FEED Changes EAR; 2025</i>

6.11.5 Residual Impacts

Project residual impacts on the marine physical environment will be primarily constrained to the construction period, and will all be either Minor or Negligible significance. Therefore, there are no significant impacts anticipated. Table 6-40 below summarises residual impacts in the marine physical environment.

Table 6-40: Summary of potential residual Impacts – Physical marine environment (Source(s): EIS (2019) and FEED Changes EAR (2025))

Impacting Process	Activity	Potential Impact	Location	Project Phase	Mitigation Code	Residual Impact Assessment	
						Residual Sensitivity / Magnitude	Residual Significance
Planned wastewater discharges Hydrotest water discharge	Controlled discharges of hydrotest water, vessel domestic wastewater and bilge water.	Localised temporary deterioration in marine water quality due to discharge volume and chemical additives (oxygen scavengers, biocides)	Orokolo Bay, Pipeline route / discharge location (Purari River, Orokolo Bay, Caution Bay or PLEM to FSO)	C	EM008 EM015 EM019 ED022	Medium/Minimal sensitivity (as per narrative assessment)	Negligible
Accidental releases of hydrocarbons and chemicals	Spill or leak of hydrocarbons and chemicals from vessels.	Deterioration in marine water quality	Orokolo Bay, Condensate pipeline to FSO, export pipeline realignment, and Caution Bay shore crossing by HDD	C	EM018 EM019 ED006	Medium/Low	Minor
	Leaks of condensate or gas from pipeline joins.						
Drilling fluids	Loss of drilling fluids	Deterioration in marine water quality	Caution Bay shore crossing by HDD	C	TBC	Medium/Minimal	Negligible
Mobilisation of sediments	Offshore pipeline construction –trenching for the pipeline in Orokolo and Caution bays	Increased suspended sediment concentrations in the water column	Orokolo Bay	C	EM037	Low/Low	Minor
			Caution Bay	C		Medium/Low	Minor
		Increased sedimentation on the seabed.	Orokolo Bay	C		Low/Low	Minor
			Caution Bay	C		Medium/Low	Minor

Notes: C = construction, O = operations, D = decommissioning

6.12 Traffic and Transportation

6.12.1 Introduction

This section synthesises Project documentation relating to transport and traffic impacts across the construction, operation, and decommissioning phases. The assessment draws on multiple studies prepared at different times and for different purposes, including the EIS (2019) assessment of commercial transport and traffic, EIS Vol. 2 Part 22 Marine and River Traffic and Transport Baseline (2017), hereafter referred to as EIS Marine & River Traffic & Transport Baseline (2017) and the D&B ESIA (2025).

Additionally, the following management plans describe key mitigations: the River Traffic Management Plan (RTMP) (L2-PLN-MAR-01, 2023), the Traffic and Transport Management Plan (L2-PLN-SDV-26), the Traffic and Transport Management Procedure (PG-P15-00-PHSE-000042) and the LALDP South (2026).

Project documentation to date includes an impact assessment undertaken for commercial traffic and transport, together with a dedicated social impact assessment of dredging and barging activities. Other sources of traffic and transport impacts are described in terms of the nature and scale of change, including the increase in activity levels and the introduction of new transport modes, rather than through a standalone significance assessment.

The scope of this synthesis includes:

- Marine and river traffic, encompassing dredging, barging, supply vessels, and other Project-related vessel movements.
- Air transport, including personnel and cargo movements.
- Terrestrial transport, including haulage, workforce movement, and local access where applicable.
- Social, environmental, and safety interactions, with particular attention to impacts on communities, fisheries, and other transport users within the PAoI.

The Project is located in a region where riverine and coastal transport provides the primary means of movement for communities, goods, and services, with very limited road infrastructure including permanent public roads. These transport routes therefore represent critical receptors, underpinning community access, livelihoods, and safety. This section integrates findings from the various assessments to provide an overview of potential Project-related transport and traffic impacts, while acknowledging the limitations and methodological differences inherent in the source documents.

6.12.2 Baseline

River Transport (Community and Commercial)

The Purari River and Delta form the central transport corridor for both communities and Project operations. River transport is recognised in the Ecosystem Services Assessment (2025), hereafter referred to as ESA (2025), as important for local communities, for subsistence and commercial navigation. Existing commercial traffic includes approximately 190 annual return trips by TEP PNG supply barges servicing Herd Base, 24–26 return trips by logging barges operating in the Evara area, and the use of small fast barge-punts for personnel and cargo movements. See Figure 6-11 for an example of an aggregate barge on the Purari River.



Figure 6-11: Barge passing by Gate 2, Herd Base (Source: TEP PNG).

Community mobility is dominated by dinghies (Figure 6-13), motorised canoes and dugout canoes (Figure 6-12), which are used for accessing gardens, sago stands, hunting and fishing grounds, schools and health services. As documented in the EIS Marine and River Traffic and Transport Baseline (2017), these trips typically last between one and four hours, although multi-day journeys also occur. Riverbanks are used for vessel storage and domestic activities, and many small craft lack life jackets, lights and navigational aids, increasing safety risks for local users.



Figure 6-12: Example of dugout canoe and motorised canoe used for local transport along river systems

(Source: TEP PNG)



Figure 6-13: Dinghy used for community transport (Source: TEP PNG)

The D&B SIA (2025) provides a detailed overview of community reliance on the river, informed by desktop review and community consultations conducted between 2023 and 2024. The Purari River and its tributaries and creeks underpin nearly all aspects of daily life for riparian communities within the PAoI, economically, culturally, socially and ecologically. The river is described by community members as a “life source,” and all villages within the study area are considered isolated, with minimal to no road access, making them highly dependent on the river and its tributaries for transport, subsistence and cultural practice.

Canoe transport (‘kanu warra’) is central to daily life in these communities, and settlements including Wabo and Ura maintain boats directly on the riverbank. The river supports daily mobility to markets, schools, health services, fishing camps, hunting areas and riverside gardens, and is frequently the sole means of accessing these services during the wet season, when flooding restricts foot travel (e.g., at Harevavo and Marea). The river is also a source of drinking, cooking, bathing and laundry water for most villages, particularly when other sources are unavailable, with designated bathing and washing areas typically located downstream of drinking water collection points.

The D&B SIA (BMT, 2025) identifies distinct gender dimensions to river use: men generally engage in fishing and trade, while women are responsible for water collection, food preparation, sago processing and gardening. This gendered division of labour means changes to river access or ecosystems may disproportionately affect women’s daily activities and wellbeing.

The river also holds significant cultural and spiritual value, including tangible and intangible heritage sites such as the Moiwaledsa women’s birthing site near Ura (in active use) and a sacred site at the Purivo Junction, near Kaevaria. Community consultations recorded existing sensitivity to river disturbance; communities in Akoma, for example, reported turbidity and declining fish populations linked to past dredging activity by Rimbunan Hijau (PNG) Ltd, and logging has reportedly reduced hunting opportunities through habitat change. These prior experiences inform community expectations regarding the Project’s own dredging and barging activities.

Coastal and International Shipping

As seen in the EIS Marine & River Traffic & Transport Baseline (2017) report, international shipping lanes in the Gulf of Papua and northern Coral Sea generally lie outside the PAol. The key exceptions are:

- A crude oil tanker route servicing the Kumul Marine Terminal
- An LNG shipping lane servicing the PNG LNG Marine Terminal at Caution Bay, crossing the Project export pipeline corridor and used by approximately 110 LNG carrier return trips per year.

Coastal shipping within the Gulf of Papua primarily supports commercial movements between Port Moresby and inland river ports including Kiunga, Kikori, Kopi, Baimuru and Herd Base. The busiest route is Port Moresby–Kiunga, with approximately 212 return trips per year. Two coastal routes intersect the Project export pipeline corridor: barges servicing Herd Base and logging barges servicing the Evara area.

Commercial fisheries

According to EIS Vol.1 Ch. 08 Existing Environment – Marine, 2019 (hereafter referred to as EIS Existing Environment – Marine, 2019), the Gulf of Papua Prawn Fishery (GOPPF) is one of the largest fisheries in PNG, with an estimated value of PGK10 million (approximately US\$3 million⁶) (Liviko et al., 2016). The fishery covers 9,600 km² and extends from about 60 km southeast of Kerema to 30 km east of the Fly River mouth, from three nautical miles from shore to around the 40 m depth contour offshore (Figure 6-14). The coastal waters zone, extending from the shore to the three nautical mile limit, is reserved for subsistence and artisanal fishing; however, Kompas & Kuk (2009) reports that about one third of the total catch from the GOPPF comes from this zone, primarily as a result of resource sharing agreements with customary resource owners.

Other commercial fisheries in the Gulf of Papua include rock lobsters, bêche-de-mer, barramundi and jewfish.

Road Transport

According to the EIS Impacts, Amenity & Climate Change (2019), there are no public roads within the PAol. Communities rely on walking tracks to access gardens, hunting grounds and forest resources. Temporary logging roads exist but deteriorate rapidly after use. Private Project roads have been constructed within PRL-15 to connect Herd Base, the CPF, wellpads and flowlines. These roads are for Project use only and do not intersect villages according to the Traffic & Transport Management Plan (2023), hereafter referred to as Traffic & Transport MP (2023).

Air Transport

The EIS Impacts, Amenity & Climate Change (2019) identifies Jacksons International Airport in Port Moresby as the primary national aviation hub and the main point of entry for Project personnel and cargo. The closest airstrip to the Project is the Purari (Herd Base) Airstrip, which is currently used for petroleum operations and Project access. Airstrips also exist at Wabo but do not support regular commercial services. The Purari Airstrip will be upgraded to accommodate Project aircraft requirements. Regular commercial passenger services do not operate in the PAol.

Cultural Heritage

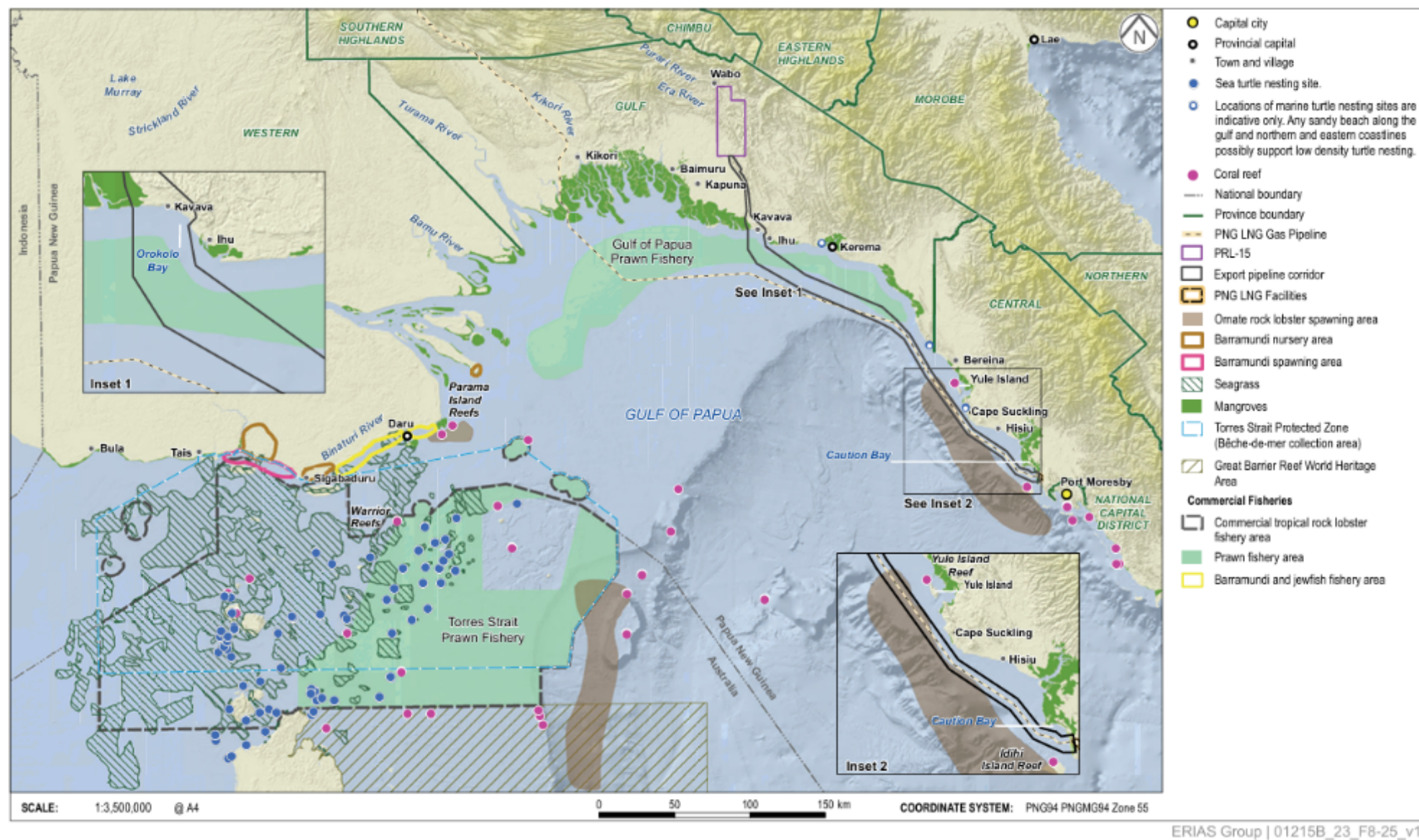
Cultural heritage surveys seen in the EIS Existing Environment – Social, Economic and Cultural (2019) report identified ancestral village sites and spirit sites along the Purari River transport corridor. These sites are of local to regional importance, are considered replicable under IFC PS 8 and are not classified as critical

⁶ Currency conversion undertaken at a rate of PGK1 = US\$0.30.

cultural heritage. These locations include ancestral village sites and spirit sites identified along the Purari River transport corridor and the Purari and Ivo-Urika river systems.

Ecosystem Services and Receptors

Riverine and coastal transport underpin several priority ecosystem services within the PAoI, supporting community access to food resources, markets, health services, education and cultural sites. As described in the EIS Impacts – Ecosystem Services (2019), the receptors associated with these services include river and coastal users, road and track users, transport workers, emergency services, riverbank households and community infrastructure. Sensitivity across these receptors is shaped by the region's heavy reliance on river access, the absence of alternative routes, the vulnerability of users and the existing safety risks associated with vessel traffic and river conditions.



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Figure 6-14: Environmental Setting of Marine Fisheries (Source: EIS Existing Environment – Marine (2019)). Note: Project footprint changes have been undertaken since production of this map and therefore the condensate pipeline is not featured in this figure.

6.12.3 Impact Assessment

Construction Phase

River and Coastal Shipping

According to the EIS Impacts, Amenity & Climate Change (2019), vessels will primarily use an established shipping route between Port Moresby and the Purari River mouth, intersecting with limited existing coastal routes. While there will be a temporary increase in vessel movements during construction, particularly in Years 1 and 2, the overall number of vessels in these coastal routes remains low. Based on historical data and existing controls, the risk of vessel collisions is considered negligible and is not assessed further.

Construction will result in a substantial increase in vessel movements above the baseline on the Purari River and coastal routes. Support vessels, accommodation vessels, dredging plant and cargo barges will operate at key locations such as Herd Base, Evava, Camp 2/3 and the CPF, with numerous barges potentially operating concurrently during peak construction.

Increased vessel traffic may result in temporary congestion, wake effects on riverbanks and small craft, and navigation risks. Impacts to community health and safety are described further in Section 6.13.

The D&B SIA (BMT, 2025) identifies three social and cultural impact pathways specifically associated with barging (B1–B3):

- **Vessel Movements and Interactions:** the movement of barges and support vessels provide an important pathway given the scale and frequency of operations and their interaction with community river users relying on the river for transport, subsistence fishing, washing, cultural and other recreational activities. Examples of interactions are; barge wake causing physical risk to small watercraft, erosion of already degraded or sensitive bank areas, and barge mooring at key construction sites that may obstruct access to traditional fishing or gathering areas.
- **Economic Opportunities:** the introduction of barging activities may generate economic opportunities across the river system due to paid employment. However, this opportunity can also lead to social disruption, particularly if perceived or actual inequalities arise or if increased cash flow contributes to harmful behaviour (e.g. alcohol misuse).
- **Personnel Interactions with Local Communities:** There will be an increase in crew interactions with communities along the river system. Where barges moor overnight at multiple locations there is a risk of communicable disease transmission, domestic violence, alcohol misuse and gambling. These impacts are not limited to the project footprints but may radiate outward depending on the extent of personnel-community engagement.

Community consultation undertaken for the D&B SIA between November 2023 and February 2024 recorded specific concerns from waterway villages regarding construction-phase vessel traffic, including: reduction in fish and food resource availability; disruption to safe river transport relied upon for healthcare, education and economic access; the need for clear, early information on vessel and dredging schedules; and vessel wake damage to riverside infrastructure such as moored canoes and gardens. Communities expressed a strong sense of ownership over the river and an expectation of genuine consultation prior to works commencing. Government stakeholders, including the National Fisheries Authority, expressed conditional support for the Project alongside expectations for social benefit delivery and future commercial fisheries development.

The RTMP (L2-PLN-MAR-01, 2023) sets out a six-part risk management framework addressing these risks: vessel management in navigation areas; marine operations management systems; marine operations resources; emergency management; aids to navigation; and implementation scheduling. Performance objectives under this framework include safe vessel arrival and departure, implementation of a Vessel Traffic

System (VTS) and navigation procedures, definition of minimum under-keel clearance requirements, and regular hydrographic survey and maintenance dredging to preserve declared navigation depths, measures that directly reduce the potential for collision, grounding and navigation channel closure affecting community and commercial river users.

Interactions between Project activities and the coastal zone bêche-de-mer fishery are expected to be highly localised and limited in duration. Due to minimal spatial and temporal overlap, impacts to this fishery are considered negligible and are not assessed further.

The Project intersects with the offshore Gulf of Papua Prawn Fishery (see Figure 6-11). Potential interactions include increased vessel traffic, pipelaying activities, and possible interaction between fishing equipment and the export pipeline. However, Project marine transport routes are largely outside primary fishing areas, vessel numbers are low, and exclusion zones will be applied during pipelaying. Given the temporary nature of construction activities, existing awareness of pipelines, charting procedures, and pipeline design measures, all potential impacts to commercial fishing activities are considered negligible and have been excluded from further assessment.

Dredging

- **Dredging for navigability:** Dredging will be undertaken to support barge and small vessels, navigability and construction of wharves, jetties and offshore pipelines at Orokolo Bay and Caution Bay. Dredging will generally occur during daylight hours in discrete campaigns, with up to two dredging vessels operating simultaneously. The exception to nighttime dredging is when the Project becomes constrained by tidal cycles (e.g. at the mouth), although dredging and support vessels will be moored at dredging locations overnight according to D&B ESIA (2025).
- **Dredging for aggregate sourcing:** Aggregate dredging is also proposed within the Purari River, upstream and downstream of the Hou Creek confluence. This activity is addressed in the Hou Creek Aggregate Dredging Management Plan (PG-P15-00-PHSE-000079, 2026), which similarly restricts active dredging works to daytime hours (6:00 a.m.–6:00 p.m.) and applies additional community-safety controls, including dedicated spotters, established protocols for the passing of community vessels through active work areas, and use of a spudded (rather than moored) pontoon specifically to reduce interference with community transport and activities.
- **Dredging for construction:** The LALDP South (2026) confirms that construction dredging (requiring at least two dredge vessels operating concurrently) will take up to approximately 68 days, while navigability dredging (one vessel) will continue for up to approximately one year, in places operating almost continuously along sections of the river. Dredging duration varies significantly by location: near Pokore Hamlet, dredging is expected to continue for approximately 34 days; at Kaevaria, for an approximate 3.5-km stretch of river over approximately 210 days; at Evara and Aivai, approximately 17 days each in association with new jetty construction; and at Apiope, approximately 30 days for the largest single volume of material extracted at the river mouth.

The D&B ESIA (2025) concluded that impacts on river morphology, water quality, aquatic habitats, navigation and culturally important sites are generally localised and temporary. Potential effects include increased turbidity, underwater noise, lighting and wake-induced erosion.

The D&B ESIA (2025) notes that turbidity, underwater noise, lighting and increased vessel movements have the potential to disrupt aquatic fauna, subsistence fishing activities, river access and broader community well-being. It also highlights that vessel wake may contribute to bank erosion, damage gardens along the river edge and create safety risks for small craft users. Sensitive communities, in particular may experience temporary disruption to fishing and river travel if these effects are not appropriately managed. While the ESIA acknowledges that construction activities may generate economic opportunities, it also cautions that

benefits may be unevenly distributed and that unmanaged interactions between workers and communities could lead to social disruption or health risks. Overall, the D&B ESIA (2025) characterises these impacts as generally localised and temporary, with the potential for heightened effects in more vulnerable communities. Impacts to livelihoods and displacement are described further in Section 6.15.

Personnel Transport

Personnel will primarily be transported by air to Purari Airstrip, followed by ferry or helicopter transfers to site, with the exception of personnel involved in Caution Bay HDD who will be housed at PNG LNG camp and personnel involved in offshore pipe lay who will be transported to site by helicopter. This movement of personnel during construction has the potential to place additional pressure on existing transport routes within the PAoI. As outlined in the Traffic & Transport MP (2023), workers recruited from within the PAoI will rely on in-field passenger ferries, while personnel arriving from outside the region will depend on regular flights into the Purari Airstrip before being transferred along the river or by helicopter to accommodation facilities and work sites.

These combined movements, expected to reach up to ten flights per day and approximately 1,000 passengers per week at peak construction, may temporarily increase congestion at the airstrip, elevate noise levels for nearby communities and intensify demand on river transport corridors. The planned upgrade of the Purari Airstrip, also described in the Traffic & Transport MP (2023), may itself generate short-term disturbance during construction. Overall, the increased personnel transport activity has the potential to create temporary delays for other river users and contribute to short-lived amenity impacts if not effectively managed.

On the river, the expected 25 daily ferry trips between the Purari Airstrip, Herd Base and nearby villages may lead to short-term congestion along commonly used community routes. These increased personnel movements may also result in temporary delays for existing commercial users, such as logging vessels, which currently make 24 return trips per year. While these delays are expected to be manageable, they represent a potential interaction between Project-related transport and existing river users.

Air Transport

Increased use of the Purari Airstrip during construction has the potential to generate localised disturbance for nearby communities. As outlined in EIS Impacts, Amenity & Climate Change (2019), airstrip operations may rise to approximately ten landings per day, which could lead to minor but noticeable increases in noise levels and general activity around the airstrip. Peak construction may also place additional pressure on national aviation capacity, as higher personnel and cargo volumes could increase demand for international flights into Port Moresby, an issue identified in the EIS Impacts, Amenity & Climate Change (2019) report assessment as requiring consideration within the cumulative impact analysis.

The movement of airfreighted cargo through Jacksons International Airport, followed by onward transport to PRL-15 primarily via river systems, may temporarily intensify traffic along established logistics routes, as described in the Traffic & Transport MP (2023). The use of cargo-specific helicopters to deliver heavy or difficult-to-access items also introduces potential short-term impacts, including increased noise, low-altitude overflights and temporary disruption to communities located near flight paths. The anticipated addition of new helipad locations near key construction areas, as noted in the Traffic & Transport MP (2023), may further concentrate helicopter activity in certain locations, increasing the likelihood of intermittent disturbance.

The Traffic & Transport MP (2023) also highlights that helicopter pads will be constructed near major construction and operational sites to support emergency medical evacuations. While these facilities are essential for safety, their presence may contribute to occasional spikes in helicopter activity, which could temporarily affect local amenity through noise and visual disturbance. The potential introduction of cargo

drones for small-item transport may also create intermittent noise or visual impacts, although these are expected to be minor given the scale of drone operations.

Road Transport

Road transport-related impacts during construction are expected to be minimal, largely because, as noted in EIS Impacts, Amenity & Climate Change (2019), there are no public roads within the PAoI and communities rely instead on walking tracks to access gardens, hunting grounds and forest resources with no reported ownership of motor vehicles or motorbikes. An exception to this, is the use of public roads for the Caution Bay scope of works. Roads utilised will be between PNG LNG Plant and Port Moresby and will have limited impacts. The Traffic & Transport MP (2023) explains that Project-related road movements will be confined to locally constructed or upgraded private roads within PRL-15, all of which are situated away from villages and public routes. As a result, the potential for Project traffic to interact with community road users is low, and any road-based impacts are considered negligible because construction vehicles operate exclusively within Project areas.

Accessways

Temporary access tracks for construction and permanent roads for use in construction and operations will be created in PRL-15. Permanent roads will be private roads, for Project use only and will be constructed to facilitate the movement of personnel and cargo to frequently used sectors including:

- Herd Base to CPF
- Herd Base to wellpads and flowlines
- Herd Base to Herd Base vicinity
- Access tracks along the PER will be temporary (Traffic & Transport MP 2023).

Temporary access roads are not required for operating long-term facilities and will be allowed to regenerate or to return to its former use and ownership after construction activities cease (Traffic & Transport MP 2023).

The creation of temporary access tracks and permanent Project roads within PRL-15 has the potential to generate short-term disturbance during construction. As outlined in the Traffic & Transport MP (2023), permanent roads will be private and used exclusively for Project purposes, facilitating the movement of personnel and cargo between frequently accessed areas such as Herd Base, the CPF, wellpads, flowlines and the wider Herd Base vicinity.

The Traffic & Transport MP (2023) also notes that access tracks along the PER will be temporary, and that no long-term access roads are required for operational facilities. Once construction activities cease, these temporary tracks will be allowed to regenerate or return to their former use and ownership.

Interacting Sensitive Receptors

Although interacting sensitive receptors are not the primary focus of the traffic and transport assessment, it is important to recognise how these receptors may experience indirect or secondary effects from Project-related movements. Traffic and transport activities are not expected to generate significant standalone impacts on biodiversity, ecosystem services or cultural heritage; however, increased vessel, aircraft and vehicle activity can create points of interaction with these receptors, particularly where transport routes pass near communities, sensitive habitats or culturally important areas. Including these receptors in the assessment therefore ensures that potential linkages, such as temporary disturbance, changes in access, or localised environmental pressures, are identified and managed appropriately, even where the overall risk remains low.

Sensitive Receptors - Terrestrial Biodiversity

According to the EIS Existing Environment – Terrestrial (2019), interactions between transport activities and terrestrial biodiversity are limited, as no public roads exist within the PAol and Project-related terrestrial transport is largely confined to existing disturbed areas, temporary tracks and operational facilities. Riverbank habitats adjacent to transport corridors may experience indirect effects from increased human presence and localised erosion during peak construction; however, no new permanent access routes are proposed and clearing of terrestrial habitats for transport purposes is minimal. These transport-related contributions to terrestrial biodiversity impacts are assessed as minor and temporary, with no habitat fragmentation or long-term ecological change anticipated.

There is also potential for introduction or spread of invasive species into or between terrestrial environments through transport vehicles. Assessment results indicate negligible to minor impacts on freshwater and estuarine biodiversity. These have been rated between Negligible and Moderate depending on the Project activity and biodiversity receptor involved.

For more details on impacts to terrestrial biodiversity, refer to Section 6.16.

Sensitive Receptors - Marine and Freshwater Biodiversity

Marine, estuarine and freshwater fauna may interact with transport activities through underwater noise, vessel movements and wake generation, particularly during construction when barge traffic increases. Potential impact pathways include temporary behavioural disturbance or physiological effects on freshwater fish, dolphins, turtles and crocodiles within the river transport corridor. Assessment results indicate that vessel traffic between the Gulf of Papua and PRL-15 results in negligible impacts on freshwater and estuarine fauna due to low receptor sensitivity and limited impact magnitude once standard operational controls are applied.

There is also potential for introduction or spread of invasive species into or between marine and freshwater environments through transport vessels. Assessment results indicate negligible to minor impacts on freshwater and estuarine biodiversity.

Impacts to freshwater and marine biodiversity are described further in Sections 6.6, 6.17 and 6.18 respectively.

Sensitive Receptors - Ecosystem Services

Temporary increases in barge traffic during construction may disturb community use of river transport routes, potentially affecting access to gardens, sago processing areas, fishing grounds and essential services. These impacts are temporary and localised and are managed through traffic coordination, scheduling and community communication measures.

The D&B SIA (BMT, 2025) identifies distinct gender dimensions to this receptor. Men generally engage in fishing and trade along the river, while women are responsible for water collection, food preparation, sago processing and gardening. Changes to river access or ecosystems may affect women's ability to carry out these daily tasks.

Transport-related activities do not involve clearing of food gardens or planted sago along the river transport corridor and are not expected to significantly affect timber or canoe tree resources, except for limited localised effects already assessed in the terrestrial biodiversity and ecosystem services sections. Impacts on commercial fisheries associated with vessel movements, underwater noise or temporary access restrictions are assessed as negligible.

The valuation, dependency and significance of ecosystem services potentially affected by transport activities are addressed in EIS Impacts Ecosystem Services (2019). Transport-related impacts do not change the overall assessment of ecosystem service importance or replaceability once mitigation measures are applied. Impacts to ecosystem services are described further in Section 6.19.

Sensitive Receptors - Cultural Heritage

Transport interactions during construction may occur indirectly through increased barge movements, potentially resulting in localised riverbank erosion near known cultural heritage sites. No direct disturbance of recorded cultural heritage sites is expected, and the likelihood of encountering previously unknown archaeological material is low due to rapid sedimentation processes, riverbank erosion and the absence of prior finds. Potential impacts on undocumented spiritual or intangible cultural heritage sites associated with river and creek environments are also considered low, reflecting the documented decline in traditional river-based cultural practices since the 1950s (EIS Impacts Cultural Heritage, 2019). Nevertheless, mitigation measures including community engagement and cultural heritage chance-find procedures will apply should culturally significant locations be identified during project activities. Indirect social impacts on material culture, including the commodification of ancestral heirlooms associated with increased cash income, are addressed in the social and cultural heritage assessments. The Project's Cultural Heritage Material Guideline explicitly prohibits the sale, trade or other commodification of cultural heritage items identified during Project activities. The significance of impacts on tangible and intangible heritage, and associated mitigation measures such as vessel speed controls, cultural heritage awareness training and chance-find procedures, are detailed in Section 6.21 and implemented through the Traffic & Transport Management Plan (2023) and the Cultural Heritage Management Plan (2023) hereafter referred to as Cultural Heritage MP (2023). Impacts to cultural heritage are described further in Section 6.21.

Operation Phase

During operations, transport activity will decrease substantially compared with construction levels:

- Barge traffic will reduce to approximately 3–5 trips per month, approaching baseline conditions. Traffic & Transport MP (2023).
- River transport will be restricted to daytime operations, with one-way navigation protocols applied in narrow or high-risk sections.
- Personnel ferry trips and air transport will occur at low frequency, primarily for maintenance and community engagement.
- Road transport will be limited to maintenance access.

Commercial fishing interactions remain minimal. Pipeline and barge operations are unlikely to conflict with prawn trawlers or other fisheries. Vessel navigation aids, exclusion zones, and operational communication will continue, EIS Marine & River Traffic & Transport Baseline (2017). Purari Airstrip usage is expected to decrease significantly.

As overall transport activity declines during operations, the potential for traffic-related impacts also reduces substantially, with only occasional and low-intensity interactions expected between Project vessels, aircraft and community users; any residual effects are therefore anticipated to be minor, localised and readily managed through standard operational controls.

Decommissioning and Closure

Decommissioning activities are expected to be of shorter duration and lower intensity than construction and operations. Potential social and cultural impacts are anticipated to be limited and temporary, primarily associated with short-term vessel movements, removal of equipment and cessation of employment opportunities. As activities wind down, impacts related to navigation, wake, noise and community interaction are expected to progressively reduce. Appropriate communication with communities during decommissioning will be required to manage expectations and minimise disruption.

6.12.4 Mitigation

Commercial Traffic and Transport

All potential impacts associated with commercial traffic and transport are managed through TEP PNG's existing procedures and embedded design controls. No additional mitigation measures are required as stated in the EIS Impacts Amenity & Climate Change Chapter (2019).

Other Traffic and Transport

The Traffic & Transport MP (2023) provides a list of proposed traffic and transport management measures and monitoring commitments which expands the following categories:

- General traffic and transport
- Onshore traffic and transport
- Marine traffic and transport
- Riverine traffic and transport

Table 6-41 below summarises the key mitigation measures identified to address potential impacts associated with increased traffic and transportation during Project construction and operational activities. These measures, drawn from the EIS (2019) outline strategies to manage risks related to increased road and vessel traffic, including impacts on community safety, biodiversity, stakeholder engagement, and livelihoods. The mitigation hierarchy focuses on proactive planning, stakeholder coordination, regulatory compliance, and implementation of traffic and transport management controls to minimise disruptions and environmental and social impacts.

Table 6-41: Mitigation measures - Traffic and transportation

Impact	Mitigation code (As in MP)	Description	Source document
Increased traffic associated with onshore pipeline construction activities, including trenching and construction of the Orokolo Bay export pipeline shore crossing.	SM027	Engage with communities potentially affected by barging operations about the barge movements and define a community development program recognising the inconvenience that waterway communities may experience.	<i>EIS/ Upstream CESMP; 2019</i>
	SEM002	The Project will prepare an updated stakeholder engagement plan for the Project's construction, operations and decommissioning phases, according to TotalEnergies' General Specifications and IFC PS1 and PS7. The updated stakeholder engagement plan will include the following key requirements: - Regular engagement with PACs on Project impacts, action plans and grievance mechanism. - Notification as early as possible to affected communities in advance of Project works, which describes the activities and how long they are expected to take. Particular focus is to be given to communities affected by project-induced in-migration. - A mechanism for enquiries and feedback. - Ongoing grievance and issues management.	<i>EIS/ Upstream CESMP; 2019</i>
Increased vessel traffic and transport associated with Project logistics and barging activities.	ED043	Continue to work with relevant commercial operators to: - Coordinate barge movements along the Purari River. - Notify them, as required, of in river Project activities and the associated hazards.	<i>EIS/ Upstream CESMP; 2019</i>
	ED042	Liaise with NMSA to establish a safety exclusion zone around offshore export pipeline construction activities.	<i>EIS/ Upstream CESMP; 2019</i>
	ED044	Inform NFA and commercial fishing fleets who operate in the vicinity of the offshore export pipeline route of construction activities, including timing of construction activities and the safety exclusion zone.	<i>EIS/ Upstream CESMP; 2019</i>
	SM016	In consultation with relevant stakeholders, develop a community emergency preparedness and response policy and procedure that clearly define roles of stakeholders in the event of Project-related emergencies or accidents affecting the community.	<i>EIS/ Upstream CESMP; 2019</i>
	EM033	Develop Traffic and Transport Management controls that include: - Posting speed limits on Project roads via posted speed limit signs. - Requiring vehicles to keep to posted speed limits. - Keeping vehicles and mobile machinery to marked trafficable areas and work sites.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
	EM014	Implement low speed limits through areas sensitive to vessel wash impacts.	<i>EIS/ Upstream CESMP; 2019</i>
	ED022	Ballast waters, liquid effluents and waste from vessels will be managed according to the MARPOL 73/78 requirements.	<i>EIS/ Upstream CESMP; 2019</i>
Increased traffic and vessel transport resulting in potential impacts on biodiversity receptors	EM024	Maintain a minimum practical distance from sensitive features to minimise potential degradation and disturbance. Buffer distances shall be ecologically relevant, considering: • Sensitive habitats, i.e. primary alluvial forest, mangroves, riparian vegetation along forest streams. • Habitats that provide focal breeding, roosting or feeding sites for sensitive fauna, e.g. caves, rock shelters, rock outcrops, large trees with hollows, large trees with nests, bird-of-paradise display trees, forest pools, large fig trees (<i>Ficus</i> spp.) and vines of the family Aristolochiaceae. • Sites that support populations of IUCN Threatened or rare and localised plant species.	<i>EIS/ Upstream CESMP; 2019</i>
	EM022	Implement lower speeds past aquatic fauna when observed in the water.	<i>EIS/ Upstream CESMP; 2019</i>
Increased traffic and vessel transport contributing to the introduction and spread of weeds, pathogens and pests.	EM023	Management controls will be developed for weed, pathogen and pest that pose a significant threat to biodiversity, including: • Specific risk-based control methods, and procedures targeting Priority 1 and 2 weeds and pest fauna. • A quarantine management program for moving people, equipment and supplies in accordance with PNG law. • Tools for field personnel to identify Priority 1 and 2 weeds and pest fauna.	<i>EIS/ Upstream CESMP; 2019</i>
Increased traffic and vessel transport affecting land access and livelihood activities through disruption, restriction	SM001	Development of Project Land Access and Livelihood Development Plans (LALDP) consistent with the goals, objectives, principles and processes described in the Land Access and Resettlement Framework (LARF) and continuously drawing on lessons learned from the land access and resettlement activities. The LALDP will adequately cater for the respective interests of the Project Affected Persons (PAPs) in accordance with criteria for eligibility and the PAPs choice of type of compensation (e.g. cash or in-kind). The LALDP will:	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
or increased pressure on existing access routes		- Describe processes for appropriate disclosure of information, consultation and the informed participation of PAPs with the aim of obtaining their free, prior and informed consent. - Provide a compensation framework with compensation for loss of assets at replacement cost; - Design livelihood programs which aim to improve or at least restore the livelihoods and standards of living of displaced persons which choose to remain in the project area of influence; and - Include special provisions for identified vulnerable individuals or groups. - If physical displacement of primary residents is required; include provisions to improve living conditions among displaced persons which have chosen in-kind compensation through provision of replacement housing. - Provide a monitoring framework for the implementation of LALDP.	
	SM002	The Project will, in consultation with local communities, government and civil society, design and deliver a diversified livelihood program that provides eligible Project affected people which choose to remain in the project area of influence with opportunities for improving their existing livelihoods and that contributes to the diversification of skills with the aim of triggering income generating activities. Livelihood programs will consider how PAPs can be involved in Project employment opportunities (direct and indirect) and how skills learned on the Project can be applied to other sectors in the local area.	<i>EIS/ Upstream CESMP; 2019</i>
	SEM003	As part of the Land Access and Resettlement Framework (LARF): - Provide a framework for stakeholder engagement on land access and livelihoods including public consultation, disclosure and grievance resolution. - Provide preliminary information to stakeholders (e.g., government, civil society) about the standards and procedures for the LARF.	<i>EIS/ Upstream CESMP; 2019</i>
Increased traffic and vessel transport contributing to resettlement pressures ⁷ .	SM031	Resettlement of Pokore Hamlet according to a Resettlement Action Plan (RAP) to be developed and assess social impacts associated with the new location.	<i>EIS Addendum; 2024</i>

⁷ The need to physically resettle Pokore Hamlet [SM031] is pending further noise assessments. Should physical displacement be necessary, the Project will be required to follow the IFC PS5 on Land Acquisition and Involuntary Resettlement and obtain FPIC from both affected households and, where relevant, host communities (IPF 2026).

6.12.5 Residual Impacts

Commercial Traffic and Transport

Within the EIS Impacts, Amenity & Climate Change (2019) report, the Purari River's sensitivity as a transport route is rated as Medium, due to it being the primary connection for local communities with no alternative roads. Current use is mostly by TEP PNG, with minimal other traffic. Although barge traffic may more than double during construction, disruptions to other vessels are expected to be localised, temporary, and manageable, resulting in a Low magnitude and Minor residual impact significance.

Transport and Access

Within the EIS Addendum (2024), residual impacts to social receptors were revised which included the river transport corridor and its receptor, the PACs. With mitigation measures in place, the residual impacts to PACs were assessed to be Negligible to Minor.

Table 6-42: Summary of potential residual impacts - Commercial traffic and transport (Source: Impacts, Amenity & Climate Change (2019))

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual Sensitivity / Magnitude	Residual Significance
Commercial vessels on the Purari River	Logistics and transport (barging along waterways)	Temporary disruption or delay of logging barges using the Purari River	River transport corridor	C	ED042 ED043 ED044 EM014 EM033	Medium/ Low	Minor

Table 6-43: Summary of potential residual impact - Transport and access for PACs (Source: EIS Addendum (2024))

Key Sensitivity	Main Activity	Potential Impact	Location of Impact / Receptor	Project Phase	Mitigation and Management	Residual Sensitivity / Magnitude	Residual Significance
Project-Affected Communities	Logistics and transport (barging along the Purari River)	Short-term disturbance of access to community services and natural resources	Project-affected and local communities along the main river transport corridor	C, O, D	SM027 SM001 SM002 SM016 SEM002 SEM003 EM033	High / Negligible	Negligible
			Pokore Hamlet	C, O, D	SM027 SM001 SM002 SM016 SEM002 SEM003 SM031 EM033	High / Negligible	Negligible

Key Sensitivity	Main Activity	Potential Impact	Location of Impact / Receptor	Project Phase	Mitigation and Management	Residual Sensitivity / Magnitude	Residual Significance
		Loss or damage to assets as a result of increased river traffic	PACs along the main river transport corridor	C, O, D	SM027 EM014 EM033 ED022 EM022 EM023 EM024	Medium / Low	Minor
			Pokore Hamlet	C, O, D	SM027 SM031 EM033 ED022 EM022 EM023 EM024	Medium / Low	Minor

Notes: C = construction, O = operations, D = decommissioning

6.13 Community Health and Safety

6.13.1 Introduction

CHS covers the potential risks and benefits to communities associated with Project activities, including workforce–community interactions, communicable and vector-borne disease transmission, traffic and transport safety (road, river and marine), emergency preparedness and response, community exposure to hazardous areas, and social risks such as Gender-Based Violence (GBV), Sexual Exploitation Abuse and Harassment (SEAH), and PIIM. This section synthesises the methodology and findings documented in the Project's existing source assessments and management plans and focuses on community-facing risks arising from construction and operations. It does not address occupational health and safety risks, which are covered in Section 6.2.

CHS also overlaps with aspects of community security, including impacts on pre-existing law-and-order conditions, constrained policing and public and private security arrangements that affect community security. For the purposes of this ESHIA Synthesis, these are covered primarily in Section 6.14 (Security) but will be referred to in this CHS section as relevant.

CHS is a key consideration for the Project given the remoteness of many PACs, limited access to health services, reliance on river and coastal transport routes, and the potential for increased interaction between communities and a large temporary workforce. Project development is expected to contribute to local economic opportunities through job creation, increased demand for goods and services, and broader participation of landowners through benefit-sharing arrangements as determined by the State during the Development Forum. In particular, the export gas pipeline realignment brings infrastructure closer to communities in the Kairuku Rural LLG, increasing the number of landowners who may qualify for Project-related benefits in accordance with the provisions of the Oil and Gas Act. The Project may also support improvements in health infrastructure and service delivery through partnerships and targeted investment, alongside capacity-building initiatives such as training programmes for local health workers and community awareness campaigns.

The assessment was informed by IFC PS 4 (Community Health, Safety and Security), which requires that Projects avoid or minimise risks to community wellbeing and ensure appropriate emergency preparedness, security management, and protection of vulnerable groups.

Relevant standards and regulatory requirements applicable to this topic are outlined in Section 4, including PNG public health and environmental regulations (e.g., the Public Health (Drinking Water) Regulation 1984 and sewerage treatment guidelines), applicable technical guidance for air and noise discharges, and international good practice requirements under the IFC General Environmental, Health and Safety (EHS) Guidelines. These are supported by WHO guidance on drinking water quality and community noise.

This section also complements other strongly linked ESHIA topics, including Stakeholder Engagement, the assessment of PIIM, and the Unplanned Events and Emergency Response sections, which together inform an integrated approach to managing CHS risks across the Project lifecycle.

6.13.2 Baseline

Approach to Baseline Collection

CHS baseline information was compiled from the EIS Vol 2 Part 16 Upstream Community Health Baseline (2017), hereafter referred to as the EIS Community Health Baseline (2017), the Community Health, Safety and Security Management Plan (CHSSMP), the Community Security Risk Assessment (CSRA), the Medical Support

to Local Communities procedure and report, Gulf Provincial Health Authority (GPHA) health-programme materials, PIIM documentation, the river/marine transport baseline, and stakeholder engagement records.

The CHS baseline also draws on community and household surveys, health worker key informant interviews, focus group discussions, stakeholder discussions with health service providers, and review of health facility morbidity data. Baseline fieldwork covered villages close to PRL-15, the export pipeline corridor, and the main navigable channels of the Purari River, with community health discussions undertaken at 14 locations and household surveys undertaken across a sample of PAoI villages.

Together, these sources describe existing community health conditions, service access constraints, safety risks, security conditions, and institutional capacity limitations across the PAoI.

Community Health and Service Capacity

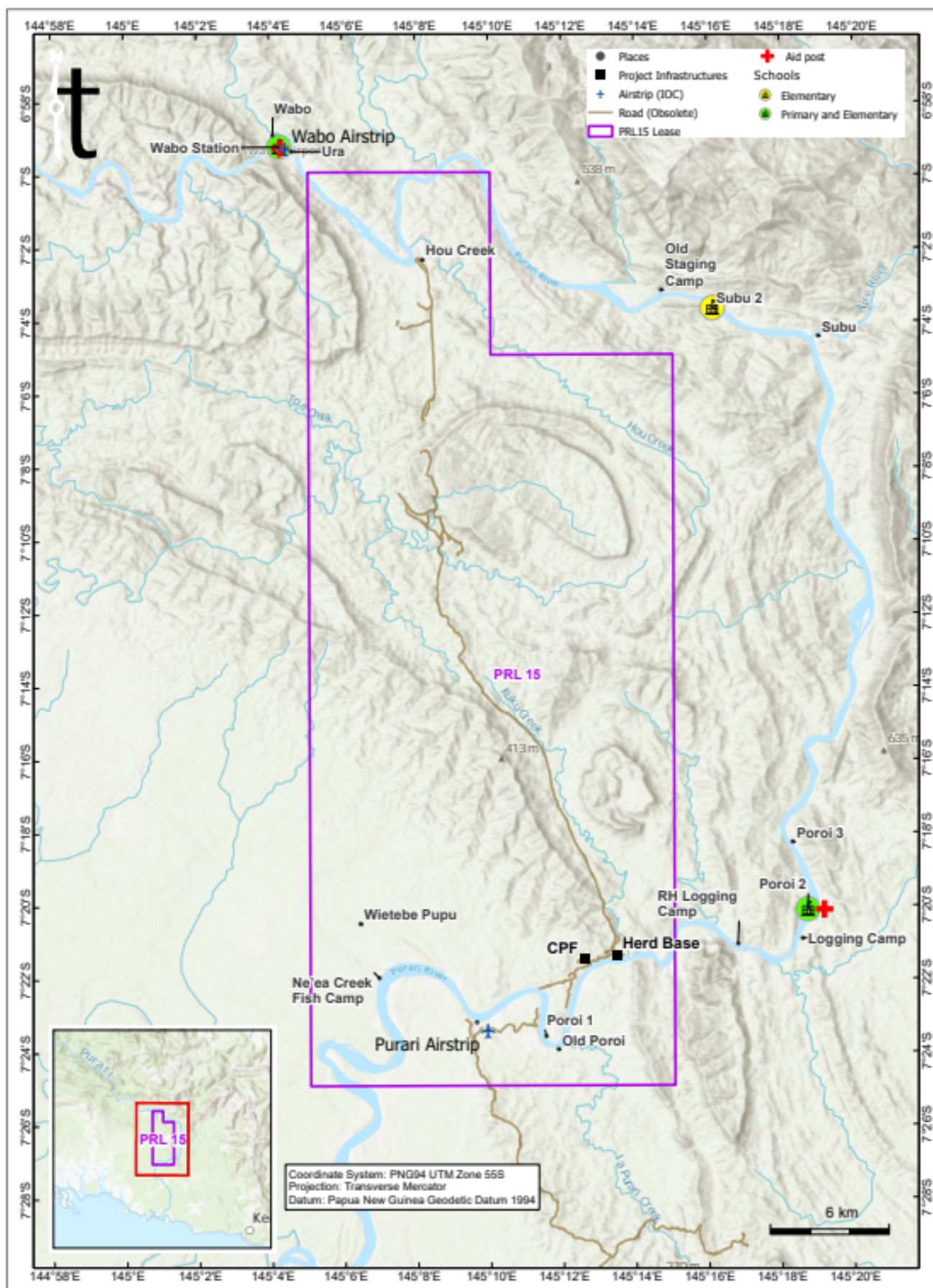
Baseline health conditions in the PAoI are characterised by a small, fragile and highly dispersed service network. The 2017 upstream health baseline identified 15 PAoI health facilities, of which nine were operating, three partially operating and three not operating. Kerema Health Centre was assessed separately because, although within the PAoI, access barriers limit its practical availability for many PAoI communities. Facilities include aid posts, sub-health centres and health centres, with service delivery heavily reliant on Kapuna and Kerema health centres and on outreach/patrol services.

Kapuna Health Centre is a critical service provider for the PAoI. Women's focus groups reported that Kapuna Health Centre provided the last health clinic in 83% of villages, the last malaria patrol in 74%, and the last immunisation patrol in 83%. Kapuna also provides mobile health clinics, immunisations, malaria patrols and WATSAN/latrines-related outreach to communities across the Kapuna, Baimuru, Orolo and Karati catchment areas, although the baseline notes that this outreach is not fully funded for the entire area.

Aid posts were found to have staffing problems, irregular operating hours or closures, while Kapuna and Kerema health centres carried much of the burden for direct care, immunisation and antenatal services despite funding and staffing constraints. Health worker interviews identified poor facility condition, inadequate staff-to-patient ratios, medicine and consumables shortages, equipment constraints, lack of water/light and the need for transport to collect wages and supplies. Community focus groups similarly identified lack of transportation, deteriorated health facilities and lack of water supply as key health concerns.

Figure 6-15 and Figure 6-16 below shows the community facilities around PRL-15 and the Onshore PER.

COMMUNITY FACILITIES IN AND AROUND PRL-15



Entity: EP/APC/PG-TEP/HSSE/BIO&ENV/GIS
 Author: E. AKIKE
 Date: 1/15/2026



Figure 6-15: Community facilities within PRL-15 (Source: TEP PNG, 2026)

COMMUNITY FACILITIES ALONG THE PIPELINE EXPORT ROUTE (PER)



Figure 6-16: Community facilities along the pipeline export route (PER) (Source: TEP PNG, 2026)

Water and Sanitation

Baseline conditions indicate low routine handwashing with soap and limited water volumes for basic hygiene in some communities. Household survey data (EIS Community Health Baseline, 2017) found drinking water comes mainly from rainwater catchments (37%), tanks (32%), rivers/creeks (16%) and shallow wells (8%), with only 3% using piped water (See Figure 6-17 and Figure 6-18). Thirty-four percent of households reported there was no toilet facility and used the bush, river or sea; only 25% reported improved pit latrines. Soap use was also limited, with only 25% of households reporting that all members used soap for handwashing. The baseline notes widespread microbiological contamination in shallow groundwater and identifies access to adequate water volumes as a factor in hygiene-related disease transmission.

Low levels of access to clean drinking water and improved sanitation increase receptor sensitivity to Project impacts due to use of the bush or river for drinking water and sanitation. Accidents and injuries, including river and marine traffic incidents, are an existing morbidity burden, and community emergency medical response capacity is limited. Limited access to clean drinking water and improved sanitation increase the sensitivity of communities to Project-related traffic and transport accidents and injuries, disease-transmission, in-migration and emergency-response impacts.



Figure 6-17: Examples of water sources for rural villages Left: Rainwater catchment and container, Subu, August 2016; Right: Water well near Larihairu village

(Source: EIS Upstream Community and Demographics Baseline Report, 2017)



Figure 6-18: Example of water tank typical of rural villages (Ikinu Village)

(Source: EIS Upstream Community and Demographics Baseline Report, 2017)

Security and Law-and-Order

Existing security conditions are an important component of the CHS baseline. The Project's CSRA describes widespread baseline law-and-order issues across the PAoI, including fighting, stealing, domestic violence, alcohol and drug abuse, land and resource disputes, sorcery-related tensions and sexual violence. Customary and village-level conflict management mechanisms such as clan leaders, village courts, magistrates and peace officers are important, but their effectiveness varies due to remoteness, limited policing capacity, inconsistent leadership and weak governance. Recorded high-impact incidents from 2022-2026 include armed threats, assaults on personnel, vessel boardings, piracy, river blockades and direct challenges to authorities. Further discussion of security risks is covered in Section 6.14.

Priority Vulnerable Locations and Groups

Disease and public-health vulnerabilities are material to the CHS impact pathways. The EIS Community Health Baseline (2017) identifies TB as a priority issue in Gulf Province and notes that drivers relevant to the PAoI include remoteness, delayed presentation to health facilities, difficulty maintaining follow-up, high household occupancy, betel-nut use/spitting, indoor smoke exposure and limited diagnostic capacity. The baseline also reports low malaria parasitaemia prevalence, but continuing vector-borne disease susceptibility, especially for pregnant women and children under five. HIV rates in samples from Kapuna and Kerema health-centre data were reported as low, at less than 0.5%, while non-HIV STI data were limited and likely under-reported, supporting the need for construction-phase STI/HIV monitoring.

The security and vulnerability assessment evidence identifies all Pawaian communities, Ne'ea Creek Fish Camp, Aivai, Aumu, Kaevaria and Evara as priority communities with low adaptive capacity and elevated vulnerability linked to law and order, women's rights, health, governance and in-migration. Women and girls are particularly exposed to GBV/SEA/SH risks, with reporting constrained by remoteness, limited service access, and barriers to confidential reporting. Riverine and coastal communities are also highly sensitive because waterways are both livelihood and transport corridors and potential routes for crime, trafficking, vessel incidents and emergency-access constraints.

Table 6-44: Summary of Baseline Health Conditions in PAoI

Baseline dimension	Existing Conditions	CHS Assessment Considerations
Health-service capacity	Aid posts have staffing, supply and operating-hour constraints; higher-level care depends on Kapuna/Kerema and river access.	Project activity may increase demand on services that already have limited capacity.
Community medical emergency response	The health baseline identifies no functioning community medical emergency response system across Gulf Province.	Traffic, river, construction, and emergency scenarios require clear referral, evacuation, and coordination arrangements.
Communicable disease and public health	Baseline concerns include respiratory illness, TB, malaria/vector-borne disease, gastrointestinal/WASH-related disease and STIs.	Workforce-community interaction, PIIM, and construction logistics may increase transmission pathways.
WASH and environmental health	Hygiene practices and water availability are constrained in some communities; flood events can rapidly worsen health risks.	PIIM, construction camps, traffic, and emergency events can add pressure to water, sanitation, and hygiene systems.
River and marine safety	River transport is integral to livelihoods and access; existing concerns include bank erosion and canoe inundation/capsize from vessel movements.	Increased Project vessel traffic, dredging and exclusion zones can affect safety, access, and emergency response.

Baseline dimension	Existing Conditions	CHS Assessment Considerations
Community security and law and order	Existing issues include fighting, theft, domestic violence, substance abuse, sorcery tensions, sexual violence and land/resource disputes.	Construction workforce, cash flow, employment expectations, and PIIM may amplify existing tensions.
Policing and local governance	Customary mechanisms are important, but formal police capacity and governance effectiveness are uneven.	Security incidents and grievances may escalate if early-warning, referral and response systems are weak.
Vulnerable groups and locations	Pawaian communities, Ne'ea Creek Fish Camp, Aivai, Aumu, Kaevaria and Evara have elevated vulnerability; women and girls face heightened GBV/SEA/SH exposure.	Management measures need to be location-specific, gender-sensitive, and accessible to low-literacy/remote communities.

6.13.3 Impact Assessment

CHS impacts have been assessed by Project phase and by the named project-area framework described in Section 2.3.3, with particular attention to highly vulnerable and service-constrained communities.

Overview of impact pathways

The Project presents a range of potential CHS risks, particularly during construction when land disturbance, increased workforce presence, and heightened transport activity may affect community wellbeing.

Construction of borrow pits (approximately 38 ha of disturbance) may temporarily restrict access to hunting and resource-gathering areas, especially near KP54 and KP60 where multiple villages are located nearby.

Riverine and coastal communities may also experience temporary disruption from dredging and shore-crossing works. Dredging in the Purari River will require exclusion zones that could affect access to fishing areas and river services for communities such as Pokore Hamlet and Poroi 1, while shore-crossing activities in Orolo Bay may affect coastal resource users. HDD construction at Caution Bay is expected to impose a temporary 500 m exclusion zone, restricting fishing vessel transit during works. Increased vessel traffic associated with dredging and barging operations (typically one or two additional vessels at a time) elevates the risk of river traffic incidents, including collisions with community canoes and damage to fishing gear or assets stored along riverbanks due to vessel wake.

Localised nuisance impacts may also occur from noise and combustion emissions generated by dredging vessels operating adjacent to villages (e.g., Pokore Hamlet, Poroi 1, Aivai), although significant health effects are considered unlikely given the short duration and dispersion conditions. Similarly, fugitive dust and noise from earthworks may affect nearby vegetation and community amenity, though separation distances generally reduce the likelihood of serious health impacts.

During operations, gas compression activities at the CPF may result in occasional noise exceedances under abnormal conditions such as infrequent flaring, with receptors including Pokore Hamlet.

Population influx is a central CHS theme, as migrants and contractors may increase pressure on already limited community health services and contribute to community tensions, alcohol-related incidents, and changes in social dynamics. Competition over jobs and resources may increase the potential for conflict between local residents and incoming workers. Gender is a key risk driver in this context, with GBV and SEAH identified as major concerns. Women and vulnerable groups may face heightened exposure to health and safety risks, with implications for social cohesion and household wellbeing.

Additional community health risks may include increased incidence of communicable, vector-borne and waterborne diseases, as well as sexually transmitted infections, particularly where health literacy is limited

and interaction between contractors and communities is high. These risks interact with existing vulnerabilities, including malnutrition, accident and injury risks, and constrained service delivery capacity, underscoring the need for robust CHS management measures, ongoing engagement, and adaptive monitoring throughout Project implementation.

Construction Phase

The CHS risk profile is highest during **construction** because this phase combines the largest workforce, increased road/river/marine traffic, dredging and barging, temporary access restrictions, establishment of worksites and camps, and heightened PIIM and community-security pressures. Potential CHS risks during construction include:

- Increased risk of traffic-related accidents involving Project vehicles, barges and aircraft.
- Increased exposure of communities to dust, noise and emissions from construction activities.
- Potential transmission of communicable diseases between the workforce and local communities, including sexually transmitted infections, water-borne disease and vector-borne disease.
- Increased risk of accidents or injuries due to interaction with construction sites, equipment and altered land access.
- Increased demand on aid posts, Kapuna Health Centre and outreach services in areas where baseline service capacity is already constrained by staffing gaps, irregular aid-post operation, transport barriers, medicine and consumables shortages, and limited referral capacity.
- Increased river, road and marine traffic affecting access to health care, markets, schools and other services.

Project Areas are exposed to different Project activities during construction. Therefore, the possible CHS impacts during construction specific to each Project Area include:

- PRL-15: accident risk from plant, vehicles and aviation; dust, noise and light near hamlets; communicable disease and vector risks in remote low-service settings.
- Onshore PER Northern Segment - Evara Area: risks associated with land access, worksite activity and transport interfaces around Evara, Kaevaria and Mapai land interests.
- Onshore PER Mid Segment - Muro Area: road traffic and worksite hazards, construction access risks, social tension linked to disputed/communal land and boundary issues around the Muro-area villages.
- Onshore PER Southern Segment - Orokolo Coast: nearshore and coastal construction safety risks, temporary beach/nearshore access constraints and communal land-use sensitivities.
- Waterways/river transport corridors: collision and wake risks to canoes and dinghies, temporary access restrictions, vessel safety, riverbank or perceived water/fisheries impacts, and river-based employment tensions.
- Offshore PER/customary fishing zones: temporary marine safety zones, offshore emergency-response challenges, low-probability spill scenarios, and short-term disruption to fishing or navigation where customary use overlaps construction areas.
- Growth Centres: pressure on WASH, clinics, schools, housing, security and social cohesion in locations such as Wabo, Baimuru, Ihu, Kikori and Kerema.

The magnitude of potential construction CHS impacts was assessed to be medium, and sensitivity of receptors, high. Resulting in potential impact significance of moderate.

Operational Phase Impacts

During **operations**, the CHS profile is expected to reduce in intensity as workforce numbers and logistics activity decline; however, ongoing risks remain in relation to:

- Ongoing traffic and marine safety risks associated with logistics and maintenance activities
- Risks associated with hazardous materials transport and storage
- Potential impacts from major accident events (e.g. spills, fires), although likelihood is low
- Long-term changes to community access patterns and safety around permanent infrastructure
- Major Hazards such as gas releases, fire and explosion, impacts on fenceline communities (see Section 6.1)
- Contamination of ground and surface waters (see Sections 6.8 and 6.9)
- Impact on the air quality (see Section 6.4)
- Noise disturbance (see Section 6.6).

The significance of potential operational CHS impacts was assessed to be minor to moderate.

Decommissioning and Closure Impacts

Decommissioning may reintroduce some construction-like risks, including traffic, dust, noise and access changes, but these are expected to be temporary and managed through established procedures.

The significance of potential CHS impacts during decommissioning and closure are assessed as minor.

6.13.4 Mitigation

The CHSS Management Plan is being revised to be corridor-wide and project-area-specific, integrating the HRIA, PIIM assessments, D&B ESIA, RTMP, EIS Addendum and project-area framework, with controls differentiated for PRL-15, onshore PER Northern, Mid, Southern segments, Orokolo Bay/coastal areas, offshore PER/customary fishing zones, waterways/river transport corridors, and Growth Centres. Key approaches include:

- Compliance with PNG law and IFC PS1/4/7
- Application of a mitigation hierarchy to CHS risks
- Meaningful, inclusive participation (with women and vulnerable groups) in CHS planning
- Emphasis on prevention
- Integration of CHSS constraints into project design, logistics, and contractor requirements
- Transparent monitoring, reporting, and adaptive management.

The following measures further help to reduce structural social vulnerabilities and manage CHS risks in areas with limited baseline health-service capacity:

- Prioritising design and routing options that avoid exposing communities to high residual CHS risks and applying robust engineering and operational controls where avoidance is not possible.
- Implementing road, river and marine traffic management measures, including driver training, vessel-user awareness, speed/wake controls, notifications, emergency response linkages and contractor obligations.
- Preventing and controlling hazardous materials risks, including during transport.
- Resourcing CHS oversight through a Community Health Specialist within the E&S team to coordinate CHS programmes and monitoring.

- Implementing communicable disease and vector-control measures aligned with government health guidance and CHSS monitoring.
- Preparing community-facing emergency preparedness arrangements, including links between contractor and affiliate ERPs and local health and emergency services.
- Addressing CHS risks in areas at risk of in-migration through coordinated CHS-PIIM planning, targeted support for critical services, and partnerships with authorities and NGOs on GBV, youth, and law and order.
- Maintaining a consolidated CHSS database and transparent reporting so that lenders, authorities, and communities can see how CHS risks are being identified, managed, and reduced over time.
- Continuing health-service support through the Project's partnership with Kapuna Hospital, MOU with the National Volunteer Service, Sago Network activities, collaboration with the Gulf Provincial Health Authority and support to local aid posts, including training for local health workers, health facility upgrades, outreach programmes, and emergency-response coordination with local communities.

These measures are being operationalised through the Service Level Agreement between the GPHA and GCSA to manage and operate the PAoI Aid Posts, the Medical Support to Local Communities procedure and the CHSSMP. The procedure requires local cases to be directed first to aid posts, with support at Gate 2 (Herd Base) where cases cannot be managed locally due to shortage of supplies, absence of aid-post staff or the need for clinical referral.

Recent health-programme material also demonstrates that Project support is being linked to broader service-capacity development with GPHA, Kapuna/Gulf Christian Services, NVS and other partners. Current and planned support includes:

- Gate 2 (Herd Base) services
- Health-facility construction and maintenance
- NVS health-worker placement
- Medical-supply procurement and distribution
- Medevac/fuel support
- Joint health patrols
- WASH programming
- Facility assessments
- Health-worker training
- Execution of responsibilities provided in the MOUs – NVS/GCSA etc.
- Coordination with GPHA on facility performance and supply issues
- Providing logistics and coordination support for the GSCA/GPHA SLA.

Figure 6-19 provides examples of the Project funded improvements to Kapuna Health Centre.



Figure 6-19: Kapuna Health Centre (Left: Main Entry, Right: Dormitory near Helipad (Source: TEP PNG)

CHS mitigation also requires addressing location-specific community security issues as health, safety and security risks are mutually reinforcing in the PAoI. Mitigation therefore includes risk-based community engagement, early-warning and grievance tracking, participation of women, youth and vulnerable groups in engagement, monitoring of migration trends, support for village-level dispute resolution and law-and-order capacity, GBV referral and confidential reporting pathways, VPSHR-aligned training and oversight for security providers, and monitoring of security-related grievances and response times. See Section 6.14 of this ESHIA Synthesis for details on Security baseline and impact mitigation.

Table 6-45 below summarises the key mitigation codes that support addressing potential impacts associated with community health and safety. Also see other relevant sections such as Section 6.2 (Labour and Working Conditions), Section 6.12 (Traffic and Transportation) and Section 6.14 (Security).

Table 6-45: Mitigation measures - Community health and safety

Impact	Mitigation code (As in MP)	Description	Source document
Project-Induced In-Migration (PIIM)	SM012	In areas at high risk of Project-induced in-migration in the PAol, undertake a feasibility assessment in consultation with relevant stakeholders on initiatives to improve health services and infrastructure, and to strengthen health outcomes.	<i>EIS/Upstream CESMP; 2019</i>
	SM028	Engage with communities and local-level governments to discourage the development of informal settlements along Project access routes and near Project facilities.	<i>EIS/Upstream CESMP; 2019</i>
	SM030	Demobilise all Project workers to their point of hire after their shift/employment is completed.	<i>EIS/Upstream CESMP; 2019</i>
	SM014	In areas of high risk of Project-induced in-migration in the PAol, undertake a feasibility assessment in consultation with relevant stakeholders on initiatives aimed at improving water, waste, sanitation and hygiene services (WASH).	<i>EIS/Upstream CESMP; 2019</i>
Increased communicable disease transmission (STIs, vector-borne, zoonotic, waterborne and respiratory diseases)	SM012	As above	<i>EIS/Upstream CESMP; 2019</i>
	SM014	As above	<i>EIS/Upstream CESMP; 2019</i>
	SM013	Partner with relevant organisations to develop a Health and Wellness Awareness Program for the Project workforce and PACs, particularly in high-risk, in-migration areas. Topics may include preventing and managing communicable and noncommunicable diseases, women's health, nutrition, hygiene and sanitation, and transport safety.	<i>EIS/Upstream CESMP; 2019</i>
	SM015	Develop a tuberculosis (TB) prevention and control program for the Project workforce, including measures to screen and confirm the medical status of TB prior to employment or assignment in the Project area. Project workers diagnosed with active TB will be demobilised to their point of hire, they will be advised to seek treatment, and the government will be notified to follow-up with their immediate family members as part of the national TB program. After treatment, a medical evaluation and fitness to work certificate will be required to resume work.	<i>EIS/Upstream CESMP; 2019</i>
	SM018	Restrict community access to Project sites	<i>EIS/Upstream CESMP; 2019</i>
Increase in non-communicable diseases	SM013	As above	<i>EIS/Upstream CESMP; 2019</i>
	SM017	Provide healthy and culturally appropriate food choices at workforce accommodation.	<i>EIS/Upstream CESMP; 2019</i>
Loss of access to livelihood and subsistence resources	SM002	The Project will, in consultation with local communities, government and civil society, design and deliver a diversified livelihood program that provides eligible Project affected people which choose to remain in the project area of influence with opportunities for improving their existing livelihoods and that contributes to the diversification of skills with the aim of triggering income generating	<i>EIS/Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		activities. Livelihood programs will consider how PAPs can be involved in Project employment opportunities (direct and indirect) and how skills learned on the Project can be applied to other sectors in the local area.	
	SEM003	As part of the Land Access and Resettlement Framework (LARF): Provide a framework for stakeholder engagement on land access and livelihoods including public consultation, disclosure and grievance resolution. Provide preliminary information to stakeholders (e.g., government, civil society) about the standards and procedures for the LARF.	<i>EIS/Upstream CESMP; 2019</i>
	SEM002	The Project will prepare an updated stakeholder engagement plan for the Project's construction, operations and decommissioning phases, according to TotalEnergies's General Specifications and IFC PS1 and PS7. The updated stakeholder engagement plan will include the following key requirements: - Regular engagement with PACs on Project impacts, action plans and grievance mechanism. - Notification as early as possible to affected communities in advance of Project works, which describes the activities and how long they are expected to take. Particular focus is to be given to communities affected by project-induced in-migration. - A mechanism for enquiries and feedback.	<i>EIS/Upstream CESMP; 2019</i>
	SM001	Development of Project Land Access and Livelihood Development Plans (LALDP) consistent with the goals, objectives, principles and processes described in the Land Access and Resettlement Framework (LARF) and continuously drawing on lessons learned from the land access and resettlement activities. The LALDP will adequately cater for the respective interests of the Project Affected Persons (PAPs) in accordance with criteria for eligibility and the PAPs choice of type of compensation (e.g. cash or in-kind). The LALDP will: - Describe processes for appropriate disclosure of information, consultation and the informed participation of PAPs with the aim of obtaining their free, prior and informed consent. - Provide a compensation framework with compensation for loss of assets at replacement cost;	<i>EIS/Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		- Design livelihood programs which aim to improve or at least restore the livelihoods and standards of living of displaced persons which choose to remain in the project area of influence; and - Include special provisions for identified vulnerable individuals or groups. - If physical displacement of primary residents is required; include provisions to improve living conditions among displaced persons which have chosen in-kind compensation through provision of replacement housing. Provide a monitoring framework for the implementation of LALDP.	
Project related accidents and injuries	SM016	In consultation with relevant stakeholders, develop a community emergency preparedness and response policy and procedure that clearly define roles of stakeholders in the event of Project-related emergencies or accidents affecting the community.	<i>EIS/Upstream CESMP; 2019</i>

6.13.5 Residual Impacts

Residual impacts to CHS are between Negligible to Moderate significance and two Positive impacts. The impacts that retain Moderate residual significance do so largely because they occur in communities with inherently high vulnerability and limited baseline services. Even well-designed mitigation measures can only partially offset pressures created by workforce presence, PIIM, and increased demand on local systems.

Across the PAol, health services, water and sanitation systems, transport access and local governance structures are structurally constrained. PIIM, workforce presence and emergency referrals could place additional pressure on systems with limited spare capacity. Even with coordinated planning and community development programmes, rapid demographic change can strain social cohesion, create inequalities, and place added pressure on leadership and decision-making structures. These changes interact with longstanding governance challenges, meaning that mitigation reduces, but cannot fully remove, the risk of social tension. This supports a residual CHS risk level of Minor to Moderate, depending on location and impact pathway.

For women, girls, and other vulnerable groups, pre-existing inequalities and limited protective services heighten exposure to GBV, SEA, and other social risks linked to workforce presence. Although codes of conduct, awareness initiatives and grievance processes will reduce potential harm, the broader social context means vulnerability remains elevated, resulting in a Moderate residual impact.

Overall, the Moderate residual significance across these impact areas reflects systemic constraints rather than insufficient mitigation. Continued monitoring, adaptive management, and sustained engagement with communities and authorities will be essential to preventing escalation and maintaining impacts at a manageable level.

Table 6-46 below describes the significance of residual impacts following mitigation and management measures as described in EIS Social Impacts (2019); D&B ESIA (2025).

Table 6-46: Summary of potential residual impacts - Community Health & Safety (Source: EIS Social Impacts (2019); D&B ESIA (2025))

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / Indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
Local health infrastructure and services	Project induced-in-migration.	Increased pressure on local health services and infrastructure.	Induced	PACs, and local communities in and around PRL-15, along the PER and along the river transport corridor. Kikori district, Baimuru and Ihu local level government.	C, O, D	SM012 SM028 SM030	Medium/ Low	Minor
Local health infrastructure and services	Project employment and procurement.	Improved access to health services and infrastructure.	Indirect	PACs, and local communities in and around PRL-15, along the PER and along the river transport corridor. Kikori district, Baimuru and Ihu local level government.	C, O, D	SM012	Medium/ Positive	Positive
Local communities; Project workforce	Project induced-in-migration	Increase in respiratory disease rates and frequency or severity of outbreaks.	Induced	Project workforce. PACs, and local communities in and around PRL-15, along the PER and along the river transport corridor.	C, O, D	SM012 SM013 SM015 SM018	Medium/ Medium	Moderate
Local communities; Project workforce	Project induced-in-migration	Increase in zoonotic disease rates and frequency or severity of outbreaks.	Induced	Project workforce. PACs, and local communities in and around PRL-15, along the PER and along the river transport corridor.	C, O, D	SM012 SM013	Medium/ Low	Minor
Local communities; Project workforce	Project induced-in-migration, increase in disposable incomes	Increase in sexually transmitted infections, including HIV and AIDS.	Induced	Project workforce PACs, and local communities in and around PRL-15, along the PER and along the river transport corridor.	C, O, D	SM012 SM013 SM018	Medium/ Medium	Moderate
Local communities; Project workforce	Change in livelihoods practices induced by Project employment and procurement.	Increase in non-communicable diseases.	Induced	Project workforce, PACs and local communities in and around PRL-15.	C, O, D	SM013 SM017	Medium/ Medium	Moderate

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / Indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
Local communities	Change in livelihoods practices induced by Project employment and procurement.	Increase in non-communicable diseases.	Induced	PACs along the PER and along the river transport corridor.	C, O, D	SM013 SM017	Medium/ Low	Minor
Local communities; Project workforce	Project induced-in-migration	Increase in frequency of water- and sanitation-related (e.g., gastrointestinal) disease outbreaks.	Induced	Project workforce, PACs and local communities along the PER and along the river transport corridor.	C, O, D	SM013 SM014	High/ Low	Minor
Vulnerable groups	Project induced-in-migration, increase in disposable incomes	Impacts associated with social determinants of health (specific to gender, substance abuse and violence).	Induced	PACs, and local communities in and around PRL-15, along the PER and along the river transport corridor.	C, O, D	SM013 SM014	Medium/ Medium	Moderate
Local communities	Project employment and procurement	Increased acceptance of modern health practices and reduction in the practice of sorcery.	Induced	Project workforce, PACs, and local communities in and around PRL-15, along the PER and along the river transport corridor.	C, O, D	SM012 SM013	High/ Positive	Positive
Local communities	Construction activities, dredging, drilling, waste generation, storage and management, discharge of surface runoff.	Increase in vector borne disease rates, frequency and severity of outbreaks.	Induced	PACs, and local communities in and around PRL-15 and along the PER.	C, O, D	SM012 SM013	Medium/ Low	Minor
Local communities	Construction activities, dredging, drilling, waste generation, storage and management, discharge of surface runoff.	Increase in vector borne disease rates, frequency and severity of outbreaks.	Induced	PACs and local communities along the river transport corridor.	C, O, D	SM012 SM013	Medium/ Negligible	Negligible

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / Indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
Project Workforce	Construction activities, dredging, drilling, waste generation, storage and management, discharge of surface runoff.	Increase in vector borne disease rates, frequency and severity of outbreaks.	Indirect	Project workforce (skilled and unskilled).	C, O, D	SM012 SM013	Medium/ Negligible	Negligible
Local Communities and PAPs	Land access (required by the Project).	Increased malnutrition rates resulting from reduced food security.*	Induced	PAPs, PACs, and local communities in and around PRL-15, along the PER and along the river transport corridor.	C, O	SM001 SM002 SEM003 See also mitigations relevant to ecosystem services in Section 6.19	Low/ Negligible	Negligible
Local Communities and PAPs	Logistics and transport.	Project-related accidents and injuries.	Direct	PAPs, PACs, and local communities in and around PRL-15, along the PER and along the river transport corridor.	C, O, D	SM016 See also mitigations relevant to traffic and transport in Section 6.12	High/Low	Minor
Local Riverine Communities	Dredging (Purari River)*	Perceived changes in water quality and contamination leading to change in behaviour regarding water use leading to long-term loss of access to drinking water and water for domestic uses.	Indirect	Poroi 1, Poroi 2, Kaevaria, Evara, Aivai, Apiope, Aumu	C, O, D	SEM002 See also mitigations relevant to ecosystem services in Section 6.19	Medium / Low	Minor
Local Riverine Communities	Dredging (Purari River)*	Changes in behaviour regarding aquatic fauna leading to long-term loss of access to food sources.	Indirect	Poroi 1, Aivai, Apiope, Aumu	C	SEM002 See also mitigations relevant to ecosystems	Medium / Low	Minor

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / Indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
						services in Section 6.19		
Local Riverine Communities	Movement of dredging and barging vessels (Purari River)	Injury and property damage from vessel interactions	Direct	Whole of river system / all communities	C, O, D	See mitigations relevant to traffic and transport in Section 6.12	Medium / Low	Minor

*For ecological impacts on food and water sources see Section 6.19 – Ecosystem Services

6.14 Security

6.14.1 Introduction

This section includes a summary of the Project's baseline, impact assessment, and mitigations for security, including those arising from recent FEED updates. It considers security conditions within the PAoI, evaluates potential negative impacts during construction and operations, and identifies mitigation measures and ongoing programmes to support implementation of good international industry practice. This section synthesises the methodology and findings documented in the Project's existing source assessments and management plans; it does not introduce new impact ratings, residual impact conclusions, or independent analysis beyond the source material.

The approach was informed by IFC PS4 (Community Health, Safety and Security) and builds on commitments established in the EIS (2019) and supporting management plans, with particular attention to security arrangements, workforce–community interactions, transport and river safety, and PIIM. An additional CSRA (2026) has also been conducted which specifically evaluates security risks affecting communities and project operations within the PAoI.

Elements of security management are also addressed within the LWC stream, including workforce codes of conduct, disciplinary procedures, camp management, and controls on worker behaviour that help reduce the potential for inappropriate conduct, harassment, and violence.

Security-relevant aspects may also be addressed through measures described in:

- Stakeholder engagement (Stakeholder Engagement Management Plan, Community Grievance Procedure).
- PIIM (Community Health, Safety and Security Management Procedure, Project Induced In Migration Management Plan).
- Emergency Preparedness and Response (Emergency Response Procedure).
- Human rights and GBV-related measures (Labour and Working Conditions Management Plan, Gender Management Plan, Project Workforce Complaints and Grievance Procedure).

6.14.2 Baseline

Project documentation indicates that security baseline data was collected through security risk assessments, PIIM situation assessments, stakeholder engagement activities, and other security management processes. This includes a Voluntary Principles on Security and Human Rights (VPSHR) framework and corporate security policies. Data collection is ongoing as part of the Project's security management framework.

Existing Community Security Trends

The Project's CSRA presents the way that security risks within the PAoI are shaped by the area's challenging geography and dispersed settlement patterns. Communities are located along the Purari River, coastal areas and delta waterways, with many settlements isolated by mangroves, swamps and forested terrain. Risk levels vary across the region according to factors such as accessibility, population concentrations, proximity to project activities and the availability of services.

As rivers and coastal routes are the primary transport networks for communities and project operations, these corridors are particularly vulnerable to criminal activity, including opportunistic theft, organised crime and trafficking. Areas with strategic importance or heightened socio-economic pressures tend to experience greater security challenges.

Security conditions within the PAol are influenced by both longstanding social factors issues and Project-related pressures. As discussed in the Section 6.13 (Community Health and Safety) the PAol experiences recurring law-and-order challenges including fighting, theft, domestic violence, alcohol and drug abuse, land and resource disputes, sorcery-related tensions and sexual violence.

Local grievances relating to land ownership, compensation, employment opportunities and broader social tensions may escalate in the context of limited governance and law enforcement capacity. Traditional dispute resolution processes, although culturally important, may be less effective in addressing disputes involving external stakeholders, financial interests or inter-community competition.

The CSRA indicates that trends in security dynamics (2016-2026) within the PAol are closely linked to levels of project activity, workforce presence and reporting mechanisms. Periods of increased engagement, particularly during early works correspond with higher recorded incident volumes, reflecting both increased exposure to risk and improved reporting visibility. Conversely, reduced operational presence results in lower reported incidents, although underlying risks persist. These trends may reflect both greater exposure to risk and increased reporting associated with higher levels of Project activity and workforce presence.

High-severity incidents recorded between 2022 and 2026, including armed threats, assaults, piracy, vessel boardings and river blockades, highlight the interconnected nature of security risks and how they reflect broader systemic issues, including weak justice mechanisms, limited deterrence and the exploitation of river transport routes.

Security Forces

The Project operates in a security environment in which the Royal PNG Constabulary (RPNGC) plays a primary role in maintain public security. The Project reports that the Government Security Forces (GSF) provides support in connection with Project related security activities under an MoU with government and remain under the command and control of the relevant Government authorities. GSF support is primarily utilised for offsite taskings. The Project also has contracted private security providers on site security services.

Security management is based on TEP PNG corporate policy as well as the VPSHR and an MoU with GSF, originally signed in 2016 and reconfirmed in 2023 by the RPNGC. The MoU governs GSF roles, and engagement within the PAol, and is based on the VPSHR, of which TotalEnergies is a member.

The Project contracts three private security providers, creating a mixed security environment that requires coordination and the application of consistent security and human rights expectations. Table 6-47 lists the receptor and sensitivities identified to date by the Project assessments.

Table 6-47: Identified security receptors and sensitivities

Receptor	Sensitivity
Local communities in project area	High
Project workforce	Medium
Security personnel (private security providers)	Medium
Government security forces (RPNGC, PNGDF)	High
Community leaders and representatives	High
Women and vulnerable groups	High

Prior to Project activities, communities generally had limited and informal interaction with the GSF. Where security incidents occurred, they were typically managed through customary mechanisms. This context heightens sensitivity to the introduction of external security personnel, uniforms, weapons, or access restrictions.

6.14.3 Impact Assessment

Community Security

The Project reports that risks are assessed through annual security risk assessments under VPSHR procedures and PIIM assessments, and the HRIA. Community engagement activities have identified, community concerns relating to law and order, workforce mobility, and influx related safety pressures. Security issues have been partially assessed through PIIM situation assessments, which included crime hotspots and location of police posts.

Overview of Impacts

Assessment documentation indicates the following:

- Interactions between project-related security personnel, the workforce, and project-affected communities have the potential to result in intimidation, harassment, and inappropriate conduct if not appropriately managed.
- PIIM may contribute to increased community tensions, opportunistic crime, alcohol-related incidents, pressure on limited RPNGC services, and additional demands on local law and order resources,
- Project-related security activities involving GSF deployed by the Government may present risks associated with the inappropriate use of authority, harassment, or the use of force, where security arrangements are not implemented in accordance with applicable requirements and standards.

Construction Phase

During construction, potential security-related risks include:

- Tensions between communities and security personnel arising from access controls, land boundaries or restricted areas.
- Escalation of disputes if security responses are perceived as disproportionate or culturally insensitive.
- Increased risk of conflict related to workforce presence, employment expectations, or benefit-sharing arrangements.
- Security and human rights risks where security arrangements are not implemented in accordance with applicable Project requirements, VPSHR principles, and IFC PS4 requirements for security personnel.

The Project's CSRA indicates that construction may amplify existing pressures associated with:

- PIIM and population growth pressure
- Limited law and order capacity
- Land and resource disputes
- Waterway-related crime
- GBV
- Alcohol and substance abuse
- Escalation of community grievances and tensions.

Operational Phase

Project assessments found that, during operations, security risks are expected to stabilise but may include:

- Long-term community perceptions of exclusion due to public and private security infrastructure such as gates and fences
- Risks associated with incident response to theft, trespass, or protest activity
- Potential reliance on public security forces in emergency scenarios, which may include the GSF.

Decommissioning and Closure

Security risks during decommissioning include tensions related to workforce demobilisation, asset removal, and changes in access. These risks are expected to be temporary and manageable with appropriate planning.

6.14.4 Mitigation

The Project is implementing a security strategy that integrates respect for human rights and community safety into its core arrangements.

Security Management

The Project implements a security management framework aligned with:

- IFC PS4 requirements
- The VPSHR
- TotalEnergies corporate security and human rights policies.

This framework emphasises prevention, proportionality, and respect for human rights.

Private Security

- Private security providers are appropriately vetted, trained and contracted under clear rules of engagement aligned with international standards and GIIP.
- Training includes human rights, use-of-force principles, cultural awareness, and community grievance handling.

Human Rights

- The Project's security arrangements are informed by the VPSHR and associated corporate security and human rights requirements.
- The Project will be revising the 2018 VPSHR Policy L1-POL-MAN-06 and VPSHR Procedure L2-PRO-SEC-03 currently in use to update current operational conditions.
- Contracted private security providers are required to adhere to internationally recognised standards, relating to human rights, conduct, and use of force.

Planning and Procedures

- The Project has developed a CSRA consistent with VPSHR and IFC PS4 expectations.
- A Security Policy has been developed and implemented outlining the security framework adopted by the Project (Upstream), the scope of this document covers all company operations, events, projects, and business interest in PNG.
- The CHSSMP will be updated to further define expectations for contractor and sub-contractor security personnel, including behaviour around communities and engagement protocols.

Oversight & Emergency Response

- The Project is requiring security oversight through contractor implementation plans, integration of the HRIA findings, and, where necessary, clear documentation of police involvement.
- The Project is developing a Community ERP with awareness programs, training, drills, and community mapping.

Government Security Forces

- The Project has entered into an MoU with the Government governing engagement with GSF in connection with Project-related security activities.
- Where engagement with GSF is required, it is governed by formal agreements clarifying roles, responsibilities and human rights expectations as per the MoU.
- Allegations of misconduct involving GSF will be documented and addressed through appropriate channels.
- Firearms use, will be managed in accordance with applicable law and VPSHR principles.

Community Interface and Prevention

The Project is planning the following measures:

- Early and ongoing engagement with communities to explain security arrangements, access restrictions and safety requirements.
- Clear communication channels for communities to raise concerns related to security conduct.
- Integration of security considerations into the SEMP (2023) and CGP.

Table 6-48 outlines mitigation measures to manage security impacts by the Project.

Table 6-48: Mitigation measures - Security

Impact	Mitigation code (As in MP)	Description	Source document
Private Security	SM025	The Project will ensure private security personnel are screened and trained on the VPSHR.	<i>EIS/ Upstream CESMP; 2019</i>
	ED038	The Project reports it has been and will continue to work with security forces in alignment with VPSHR.	<i>EIS/ Upstream CESMP; 2019</i>
Oversight and Emergency Response	SM016	In consultation with relevant stakeholders, develop a community emergency preparedness and response policy and procedure that clearly define roles of stakeholders in the event of Project-related emergencies or accidents affecting the community.	<i>EIS/ Upstream CESMP; 2019</i>
Community Interface and Prevention	SM018	Restrict community access to Project sites.	<i>EIS/ Upstream CESMP; 2019</i>
	SM024	Support sustainable initiatives to strengthen village law and order organisations (e.g., village courts, local police and churches).	<i>EIS/ Upstream CESMP; 2019</i>

6.14.5 Residual Impacts

Security-related residual impacts were assessed as part of the EIS (2019) and are presented in Table 6-49. Residual impact significance has not been assigned for all aspects of security. The HRIA and CSRA assess potential community security impacts in more detail. The Project has committed to conducting further CSRA in alignment with PS4 and VPSHR expectations.

Table 6-49: Summary of potential residual impacts - Security (Source: EIS Social Impacts (2019))

Key Sensitivity	Main Activity	Potential Impact	Direct/ Indirect/ Induced	Location of Activity/ Receptor	Project Phase	Mitigation and Management	Residual Sensitivity / Magnitude	Residual Impact Significance
Community vulnerability and exposure to security personnel (incl. GSF and private security)	Security arrangements; security provider operations; interactions at sites, transport routes, and community interface points.	Potential human rights abuses committed by state and non-state security forces.	Direct and indirect	PACs and local communities in and around PRL-15, around the PER and river transport corridor.	C, O, D	SM025 SM016 SM018 ED038	High / Negligible	Negligible
Community relations	Project induced-in-migration, increase in disposable incomes.	An increase in antisocial behaviours and crime.	Induced		C	SM016 SM024	High/ Low	Minor

Notes: C = construction, O = operations, D = decommissioning

6.15 Land, Livelihoods, and Displacement

6.15.1 Introduction

This section synthesises the methodology and findings documented in the Project's existing source assessments and management plan relating to land, livelihoods, and displacement. It does not introduce new impact ratings, residual impact conclusions, or independent analysis beyond the source material.

For land, livelihoods and displacement, the ESHIA Synthesis uses the named project-area framework described in Section 3.2 aligned with LALDP implementation⁸. This segmentation allows the Project to differentiate between heavily forested customary uplands, highly river-dependent communities, coastal villages, marine fishing grounds, and peri-urban land markets, as recommended by the EIS (2019) peer review and IFC PS5.

The project areas are:

- PRL-15 covering upstream licence areas, landowning clans and CPF/associated access and logistics areas.
- The onshore PER divided into Northern Segment - Evara Area, Mid Segment - Muro Area, and Southern Segment - Orokelo Coast.
- Waterways/river transport corridors covering the Purari, Urika-Ivo, and Port Romilly-Wame-Varoi rivers and associated communities.
- Offshore PER/customary fishing zones covering possible encroachment on traditional fishing areas from Orokelo Bay toward Caution Bay.
- Growth Centres which are treated as indirect economic-displacement risk areas where in-migration, land-market change, and service pressure may affect vulnerable households.

Land tenure in PNG, and the identification of Project-affected people, is complex. Clans rather than individuals hold customary ownership and use rights, determined through genealogy, historical occupation and use. The onshore PER SMLI studies identified approximately 127 clans (around 42,000–44,000 people) within the onshore pipeline corridor. These studies explicitly note overlapping clan boundaries, duplicated or similar clan names, as well as clan fission and renaming over time, which reflect dynamic social histories but also elevate the risk of disputes over land access, compensation, and benefit sharing. This complexity means that Project impacts and entitlements often extend beyond formally recognised landowners to include secondary users, tenants, and people accessing land and resources through kinship or customary arrangements.

Livelihood dependence across the PAoI is mostly based on location and resources, particularly in riverine and wetland environments. The Purari River functions as a critical livelihood artery rather than simply a physical feature. Fisheries, sago harvesting, hunting, riverbank gardening, and forest use underpin food security, while the river also provides the primary transport route to markets, schools, and health services in areas with little or no road access. The Project's D&B ESIA (2025) highlights that many households rely on multi-day stays at riverside camps during sago processing periods, and that fishing camps along the river and delta are integral to seasonal livelihood strategies. As a result, even temporary changes to river conditions can have disproportionate livelihood effects.

⁸ To note at the time of writing this document, the LALDP North report is currently being developed and hence not been referenced.

The PAOl crosses a diverse range of land, river, and marine tenure systems (see Section 3 Project Description) held under customary law by various Indigenous language groups and clans. In PRL-15, the Project's licence area is mostly unsettled but is owned and used by Pawaia clans whose villages (Poroi 1 and 2, Ne'ea Creek, Pokore Hamlet, and others) are situated along the Purari River and its tributaries. The SMLI PRL-15 report identified eight Pawaia clans as landowning groups for the proposed PDL, along with additional Pawaia and Kaura clans for the proposed onshore pipeline licence and processing facility licence.

The D&B ESIA (2025) described Kikori District as home to seven language-based groups—Pawaia, Koriki, Iare, Ahia, Kaimare, Maipua, and Orokolo—whose settlements are along the Purari River and delta. Offshore, the SMLI PER noted 14 coastal Orokolo villages with customary rights to coastal and marine fishing grounds intersecting the offshore pipeline route, as well as traditional artisanal fishing areas extending several (3-12) nautical miles offshore.

Land ownership in the Gulf lowlands is almost entirely customary, organised through clan-based tenure that defines rights to gardens, forests, sago swamps, and fishing grounds. Overlays from logging concessions and a large Special Agriculture Business Lease (SABL) covering much of Baimuru District have created additional layers of formal rights over customary land, with related land disputes and benefit-sharing grievances documented in the PRL-15 SMLI.

6.15.2 Baseline

Baseline Data Sources and Methods

As part of the SMLI studies, initial desktop screening used satellite imagery, engineering alignments, and participatory mapping to identify potential “hot spots” where the proposed footprint or logistics corridors could intersect dense settlement clusters, high-value gardens, sago stands, key fishing grounds, and market or transport nodes so that these areas could be avoided or minimised during design. The Project then deepened its understanding of these areas through village- and clan-level engagement, including separate sessions with women, youth and non-landowning resource users, to capture intra-household patterns of land, river and sea use. As part of the SMLI, the Project also undertook field verification through systematic community walkovers with local members/elders, supported by GPS/GIS recording to confirm boundaries, asset locations and land-use practices. The D&B ESIA (2025) supplemented this work, covering 23 villages and combining desktop review, targeted studies, and community consultation.

Livelihood Systems and Dependence on Land and Water

The EIS Addendum (2024) reports that residents clear small patches of tropical forest for settlements and food gardens, plant sago along riverbanks and swampy areas, and depend on hunting and fishing for protein. Sago cultivation is the main staple in lowland regions, supplemented by garden crops like bananas, *kaukau* (sweet potato), (see Figure 6-20 below) and greens, with coconuts and sago also serving as key staples for remote inland communities that reportedly rely almost entirely on native flora and fauna for their livelihoods and wellbeing.

The SMLI PRL-15 ethnography further details Pawaia gardening and hunting: lowland Pawaia gardens in the potential inundation zone are dominated by sago palms, while upland Pawaia near Karamui demonstrate more intensive gardening of various vegetables. Hunting wild pigs, cassowaries, and smaller game, along with collecting forest materials for housebuilding, remain essential subsistence activities.

Along the Purari River and delta, the D&B ESIA (2025) and SMLI PER confirm that riverine communities depend heavily on the river system for food production, water, and access. At Apiope, Aumu, Aivai, Evara, and Kaevaria, households rely on the river for sago processing, fishing, domestic use, and transport (See examples of fishing and fishing equipment in Figure 6-21). Turtle eggs, crocodiles, and fish are harvested

from sandbars and swamps, and drinking water is drawn from the river when tanks and wells fail, particularly after flooding.



Figure 6-20: “Kaukau” or sweet potato mounds (Source: TEP PNG)



Figure 6-21: Person river-fishing at Evara (left); Fishing nets at Apiopie (right) (Source: Fisheries & Livelihoods Assessment of Purari River and Delta Communities, 20123)

Community-level profiles for Subu 2 and Ura similarly emphasise that livelihoods “greatly depend on the river,” with sago, fish, and prawns underpinning food security, and extended stays at riverside sago camps required for processing.

The main sources of drinking water for PAol communities are 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.

At the provincial level, the D&B ESIA (2025) notes that 80–85% of Papua New Guineans and the majority of rural residents in Kikori District depend on subsistence farming and fishing, with minimal wage employment and low educational attainment, particularly for women. Project studies show that these factors increase livelihood vulnerability to restrictions on land and resource access.

Coastal and marine livelihoods at Orokolo Bay and in the nearshore Gulf are also shown to be heavily reliant on resources. The offshore SMLI PER describes villagers using small outrigger canoes, stationary and gill nets, hook-and-line, and other traditional methods to fish in coastal waters (see Figure 6-22 below), river mouths, and inlets such as Mihamaa Creek and Aievi Passage. Fishing is seasonal, with south-east trade winds limiting sea access, and threadfin salmon, barramundi, and other species providing subsistence and cash income when conditions permit. The Aivai Village Fisheries Profile (2025) documents mixed-gender participation in artisanal fishing in Orokolo Bay (e.g., Mirimurua fishing area), targeting a wide range of species for household consumption and sale, often through community-managed fishing grounds that overlap among households and clans.



Figure 6-22: Fishing on the Orokolo coast (Source: TEP PNG)



Figure 6-23: Marea fishing village near the coast at Orokolo Bay (Source: TEP PNG)

Existing Displacement, In-migration, and Vulnerability

The social baseline reflects a history of environmental displacement and settlement change that shape current exposure to Project-related displacement. The PRL-15 SMLI records recent village resettlement by Pawaia communities due to flooding and notes that modern villages such as Poroi, Ura, Wabo, Subu, and Ururu are relatively recent creations compared to earlier patterns of mobile forest camps (*kombati*).

The concentration of people in central villages has enabled service provision. However, it has also meant that many families now live on other people's land, with constrained access to their own sago stands and customary land.

In the Purari delta and Orokolo coastal belt, repeated flooding events, logging, and historical concessions (logging licences and SABLs) have generated land disputes and shifts in settlement patterns, including people moving closer to transport and service nodes but sometimes further from their traditional resource bases.

The D&B ESIA (2025) reports that communities are already concerned about perceived declines in fish stocks and the loss of local wells due to flooding, which intensifies dependence on remaining aquatic resources and on river water for drinking. These existing pressures, combined with low access to services and the centrality of the Purari River as a transport corridor, contribute to a baseline characterised by high livelihood vulnerability and limited resilience to further loss or restriction of resource access.

6.15.3 Impact Assessment

The EIS (2019) drew on a consolidated evidence base comprising the PRL-15 SMLI and PER SMLI clan studies, the Land Access and Livelihoods Framework (LALF), draft land access and compensation procedures, fisheries and waterways livelihoods studies, specific D&B ESIA (2025), and PIIM assessments for Wabo, Ihu, Baimuru, and Kerema. The EIS Addendum (2024) complements these sources with updated Project design and confirms the upstream facilities as located in sparsely populated, forested terrain accessed primarily via the Purari River, and by recent CHA and biodiversity work that further clarifies overlaps between livelihood areas and sensitive aquatic ecosystems.

Impacts were analysed through an IFC PS5 lens, distinguishing:

- Potential physical displacement of dwellings and public facilities in one specific location.
- Economic displacement through loss of access to land or water resources, even where households are not physically relocated, including:
 - o Land acquisition and permanent loss of use
 - o Restrictions on access to land, river, and marine resources (including temporary safety and exclusion zones).
- Indirect and PIIM-related effects, including market speculation, and rental “squeezing out” of poorer households. This also includes additional pressure on water and sanitation services, local food systems, housing availability, and community cohesion in settlements experiencing in-migration and service constraints.

Economic and Physical Displacement Context and PS5 Risk

Project assessments have demonstrated that population displacement within the PAoI is predominantly economic rather than physical. Most affected people are anticipated to experience impacts through temporary or permanent restrictions on access to customary land, rivers, fisheries, sago areas, gardens, and other natural resources linked to subsistence and cash livelihoods, rather than through the loss of housing. These risks are particularly relevant for highly river and resource-dependent communities along the Purari transport corridor, and coastal and marine users near Orokolo Bay. Localised physical displacement remains possible at Pokore Hamlet if confirmed by further noise assessments. Should physical displacement be necessary at Pokore Hamlet, the Project will follow IFC PS5 and obtain FPIC from both affected households and, where relevant, host communities (IPF 2026).

For PRL-15, the EIS Addendum (2024) identifies potential impacts on the livelihoods of persons who use the largely unpopulated licence area for subsistence gardening, hunting, and resource collection, as well as impacts on income from forest logging resources and access along the river transport corridor. It notes that although the CPF footprint has been reduced, the P3 site will require exclusion zones extending into the Purari River, restricting community use of those areas. At the same time, Pokore Hamlet and nearby receptors are shown to remain dependent on surrounding land and river areas for daily livelihood activities. See Figure 6-24 showing the environment surrounding Pokore Hamlet.



Figure 6-24: Aerial photo of Pokore Hamlet (Source: TEP PNG)

Project-wide, the social sensitivity framework used in the EIS (2019) and EIS Addendum (2024) treats sensitivity as a function of land ownership and tenure complexity, risk of in-migration, patterns of land and water use, and the presence of both physical and economic displacement risks for highly livelihood-dependent communities.

Receptor list:

- Customary landowners/clans, including land and riverbank users (gardeners, fishers, hunters)
- Households losing assets and/or land access
- Tenants/users without formal recognition
- Vulnerable households
- Host communities (if physical displacement occurs).

Findings by Project Area

Risks per Project area are presented in Table 6-50.

Table 6-50: Summary of potential impacts on land and livelihoods by project area

Project Area	Area / Description	Main Land / Livelihood Impacts	Displacement Type (PS5)
PRL-15	Upstream area around the Elk-Antelope fields, CPF, wellpads, access roads, airstrip and logistics areas.	Land-take and access restrictions affecting customary gardens, hunting and gathering areas, forest-product collection areas, small-scale timber resources and local movement routes.	Mainly economic displacement of land-based livelihoods; potential physical displacement of dwellings at Pokore Hamlet, close to Project infrastructure.
Onshore PER North Segment - Evava Area	Northern onshore pipeline export route, including right of way, temporary workspaces, access tracks and nearby customary land-use areas.	Loss or temporary restriction of access to gardens, sago, forest resources, hunting areas and local pathways within or near the pipeline corridor.	Economic displacement associated with loss or restriction of access to land-based livelihood resources.
Onshore PER Mid Segment - Muro Area	Mid-section of the onshore PER through inland customary land-use areas associated with Muro and neighbouring clans.	Temporary and permanent disturbance to gardens, sago areas, fruit and timber trees, hunting areas, fishing places and culturally important access routes.	Economic displacement of land and resource-based livelihoods
Onshore PER Southern Segment - Orokolo Coast	Coastal and near-coastal section of the PER, including Orokolo Bay landfall and shoreline villages such as Harevavo, Marea, Larihairu, Kaivu, Kovu, Huruta and Iuku.	Temporary disruption or restriction of access to beachfront gardens, dunes, mangroves, fish landing points, canoe moorings, nearshore fishing areas and coastal movement routes.	Economic displacement may occur through loss or restriction of access to coastal and nearshore livelihood sites
Offshore PER/customary fishing zones	Customary marine-use areas in the Gulf of Papua and near Caution Bay used for small-scale fishing, navigation and coastal travel.	Temporary disruption to specific fishing grounds, navigation routes and customary marine-use areas during offshore construction and vessel activity.	Economic displacement of marine fishing and navigation uses.
Waterways/river transport corridors	Purari River system and associated waterways used for transport, fishing, sago processing, water collection, riverbank gardens and access to services.	Temporary disruption to fishing grounds, fish camps, river landings, riverbank gardens, riparian forests and canoe/dinghy transport routes from dredging, barging, navigation aids and vessel movements.	Economic displacement of river-dependent livelihoods, including fishing, sago, riverbank gardening and river transport.
Growth Centres	Growth-centres including Wabo, Baimuru, Ihu, Kikori and Kerema, where indirect PIIM and economic change may occur.	Pressure on land, housing, services and local markets; speculative land transactions; rising rents and land prices; and pressure on informal settlements and vulnerable tenants.	Indirect, market-driven economic displacement of poorer households, tenants, non-landowning relatives and other vulnerable groups.

6.15.4 Mitigation

Mitigation Framework Hierarchy

The Project is managing land, livelihood and displacement impacts through an integrated land access, compensation and livelihood restoration approach that consolidates the IPF (2026), the Land Access and Compensation Procedure, the ICP/FPIC Implementation Plan (2025), and the LALDPs North and South. This approach reflects the refined Project footprint and the improved understanding of cumulative impact pathways, particularly for river use, waterway communities, coastal and marine access, and Project-induced in-migration.

Mitigation options were developed and sequenced in line with the mitigation hierarchy, with a deliberate focus on:

- Route and siting optimisation to avoid densely settled and highly sensitive livelihood areas
- Clear, transparent land access and compensation modalities by project area
- Livelihood restoration and improvement measures tailored to riverine, coastal, and peri-urban contexts, including specific attention to women, youth, and other vulnerable groups.

Land Access and Livelihood Development Planning

The LALDPs are intended to operate alongside the Community Development Plan (CDP, L2-PLN-SDV-05), the National Content Plan, the Stakeholder Engagement Plan and the CGP.

The LALDP South (and North) have been prepared to meet the IFC PSs, specifically the PS5 requirement for a Livelihood Restoration Plan and the PS7 requirement for an Indigenous Peoples Plan. The nomenclature 'Land Access and Livelihood Development Plan' reflects that the documents function as both a Livelihood Restoration Plan and Indigenous Peoples Plan. In this way, the LALDP goes beyond livelihood restoration and describes the sustainable development benefits and opportunities to be provided to indigenous communities, customary landowners and users directly affected by Project activities. The LALDP also describes the processes for ICP and FPIC, and how these have informed the LALDP. Relationship Between LALDPs and Related Project Plans is shown in Figure 6-25.

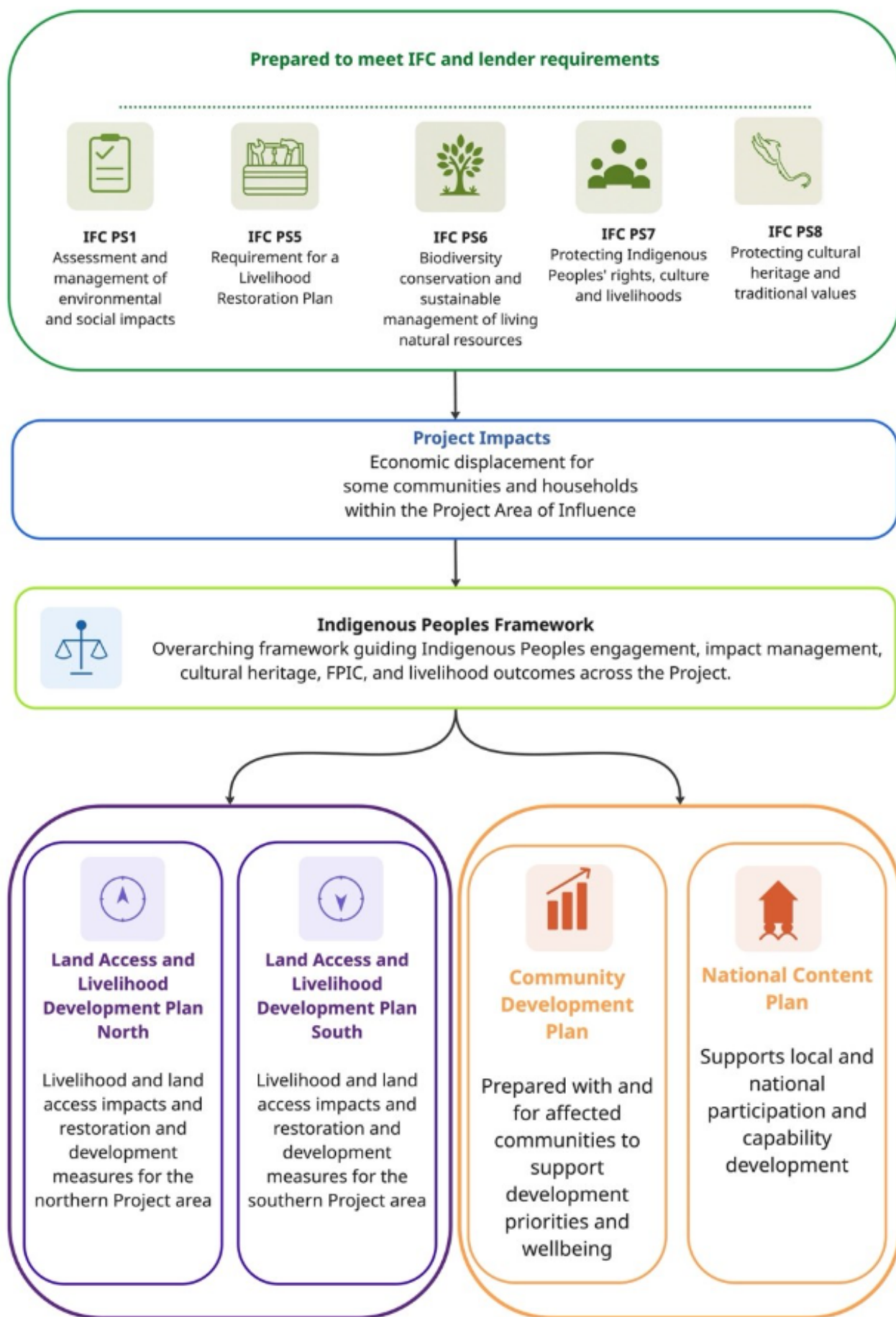


Figure 6-25: Relationship Between LALDPs and Related Project Plans (Source: LALDP South, 2026)

Compensation, Access Restoration and Livelihood Support

The Project's livelihood response aims to maintain or improve the livelihood outcomes of economically displaced households and clans. Key measures include compensation at full replacement cost before Project land access; restoration or replacement of access to gardens, sago, forest products, fisheries, river landing points, traditional pathways and coastal resources where practicable; and transitional support where construction or safety restrictions temporarily affect access to productive assets or livelihood areas.

Purari River and Waterway Livelihoods

The Project is undertaking FPIC with affected river communities and will implement the relevant LALDP to address potential temporary and longer-term access restrictions, increased travel time and cost, and changes to river fishing and transport associated with the adopted Purari dredging and barging option. Consistent with the IPF (2026), the LALDPs (and CHSSMP) are being developed and implemented in consultation with affected communities and include measures to mitigate impacts on river-based livelihoods and maintain access to culturally important waterways. The Project will also build on footprint reduction efforts and recommendations for further studies on river fishing practices and waterway uses.

Orokolo Bay and Coastal Access Measures

For the Orokolo Bay coastal landfall and export pipeline area, the Project will include Orokolo-specific measures to maintain community access, protect livelihood resources and remedy verified Project-related impacts. These measures will include:

- Maintaining designated community crossings during shore-crossing construction
- Communicating access arrangements to affected communities in advance
- Restoring full community access after construction.

The relevant land access, stakeholder engagement and grievance-management processes will define eligibility, compensation and assistance for affected gardens, sago, economic trees, nearshore/intertidal fisheries users, fish landing areas, canoe access and other livelihood assets or resource-use areas identified through SMLI, fisheries baseline work, consultation and grievance records.

Where monitoring, consultation or the community grievance mechanism identifies unforeseen Project-related impacts on livelihoods or water availability, including reduced access to wells, freshwater sources, fishing areas, gardens, sago resources, canoe routes or community facilities, the Project will investigate the issue with affected users and implement corrective or remedial measures consistent with the stakeholder engagement process and community grievance mechanism. Such measures may include temporary alternative access, temporary water supply, compensation at replacement cost, transitional livelihood support, targeted fisheries or livelihood-development support, and restoration of affected access routes or resources where practicable.

Offshore and Marine Livelihoods

The offshore and coastal environment, following completion of the baseline studies, has been included in the LALDP South to address impacts that are identified. It establishes a framework for engagement and benefit streams with coastal and island communities, including those reliant on riverine and coastal fishing areas and navigation routes within the PER corridor and safety zones.

Physical Displacement Risk at Pokore Hamlet

The Project is also creating targeted measures for high-risk interfaces. For Pokore Hamlet, additional noise modelling is required to confirm residual noise levels during the operation phase. If it becomes necessary, the Project will manage any potential physical resettlement at Pokore Hamlet through a Resettlement Action

Plan (RAP). In the meantime, the Project is committing to maximising embedded design controls and operational measures to avoid resettlement whenever possible.

Land Access Mechanisms and Tenure Disclosure

Project impact assessments have highlighted the mechanisms for land access by project area and affected clan/community group as key mitigations. The Project will specify where land will be accessed through Clan land use agreements (IPF 2026), state acquisition, leases, or other instruments based on SMLI analysis of customary tenure and existing disputes in PRL-15, as well as PIIM analysis on informal land agreements and settlement growth in areas such as Kerema and Kikori. The Project will disclose these arrangements to affected clans and peri-urban residents. Transparent legal pathways for land access and use will aim to reduce opportunistic land transactions, intra-clan conflict, and unmanaged socioeconomic change.

Programme Areas and FPIC Prioritisation

The LALDPs identify four principal programme areas: agriculture, food security and nutrition; fisheries, river and coastal livelihoods; micro-credit and community funding support; and education, workforce participation and capacity building. These programmes will be applied through detailed management surveys, inventory of losses, participatory livelihood typologies, community and clan engagement, and monitoring of whether affected households achieve pre-Project livelihood outcomes or better.

LALDPs engagement applies a sliding-scale ICP/FPIC approach (see Table 5-2). Tier 1 communities are those experiencing cumulative land and river/waterway/coastal impacts and require FPIC with high or moderate level of engagement; Chapter 7 of LALPD South identifies Pokore Hamlet, Purari Airstrip House, Evava, Aivai, luku, Mareke, Kaevania and Apiopie in this tier. Tier 2 communities experience a single significant pathway and require FPIC or structured ICP case-by-case; Tier 3 communities experience short-duration construction impacts and require ICP. FPIC verification is tracked through evidence mapped against phased objectives, including consultation records, signed FPIC MOUs, LALDP/CDP implementation records and grievance records.

The Project will specify the legal mechanism for land and water access by segment, including where land will be accessed through Clan Land Use Consent Agreements, In-Principle Compensation Agreements, state acquisition, leases or other instruments based on SMLI analysis, customary tenure, Ministerial Determinations and known disputes. These mechanisms will be implemented in accordance with PNG law and IFC PS1, PS5 and PS7 requirements, and incorporated into the ESMS, contractor scopes of work and relevant management plans.

Monitoring, Grievance Response, and Adaptive Management

Implementation will remain participatory and linked to the ICP/FPIC process. The Project will continue targeted engagement with women, youth, vulnerable households, non-landowning resource users, waterways communities and other affected stakeholders so that compensation, access to restoration, livelihood programmes and benefit opportunities are not limited to formal landowners where broader customary use or livelihood dependence is present. Monitoring will include community feedback, grievance trends, livelihood restoration outcomes and adaptive management actions where agreed measures are not achieving the intended results.

Table 6-51: Mitigation measures - Livelihoods and displacement

Impact	Mitigation code (As in MP)	Description	Source document
Land Acquisition	SM001	Development of Project Land Access and Livelihood Development Plans (LALDP) consistent with the goals, objectives, principles and processes described in the Land Access and Resettlement Framework (LARF) and continuously drawing on lessons learned from the land access and resettlement activities. The LALDP will adequately cater for the respective interests of the Project Affected Persons (PAPs) in accordance with criteria for eligibility and the PAPs choice of type of compensation (e.g. cash or in-kind). the LALDP will: - Describe processes for appropriate disclosure of information, consultation and the informed participation of PAPs with the aim of obtaining their free, prior and informed consent. - Provide a compensation framework with compensation for loss of assets at replacement cost. - Design livelihood programs which aim to improve or at least restore the livelihoods and standards of living of displaced persons which choose to remain in the project area of influence. - Include special provisions for identified vulnerable individuals or groups. If physical displacement of primary residents is required: - Include provisions to improve living conditions among displaced persons which have chosen in-kind compensation through provision of replacement housing. - Provide a monitoring framework for the implementation of LALDP.	<i>EIS/ Upstream CESMP; 2019</i>
	SEM001	Through its stakeholder engagement programs and activities, the Project is undertaking a process of free, prior and informed consent (FPIC) with the project affected persons in the Project area in accordance with the International Finance Corporation (IFC) Performance Standard (PS) 7. For example: - The Project will engage an independent organisation to provide legal support to project-affected persons regarding land access, so that they are fully informed of their rights and obligations, and that they enter into agreements willingly and without duress. - The Project will document a mutually accepted process between the Project and Project-affected persons, and evidence of agreement between the parties as the outcome of negotiations.	<i>EIS/ Upstream CESMP; 2019</i>
	SEM003	As part of the Land Access and Resettlement Framework (LARF): - Provide a framework for stakeholder engagement on land access and livelihoods including public consultation, disclosure and grievance resolution. - Provide preliminary information to stakeholders (e.g., government, civil society) about the standards and procedures for the LARF.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
Livelihoods	SM002	The Project will, in consultation with local communities, government and civil society, design and deliver a diversified livelihood program that provides eligible Project affected people which choose to remain in the project area of influence with opportunities for improving their existing livelihoods and that contributes to the diversification of skills with the aim of triggering income generating activities. Livelihood programs will consider how PAPs can be involved in Project employment opportunities (direct and indirect) and how skills learned on the Project can be applied to other sectors in the local area.	<i>EIS/ Upstream CESMP; 2019</i>
	SM026	Maintain designated crossing locations during construction of the onshore export pipeline and shore crossing to enable community access.	<i>EIS/ Upstream CESMP; 2019</i>
	SM027	Engage with communities potentially affected by barging operations about the barge movements and define a community development program recognizing the inconvenience that waterway communities may experience.	<i>EIS/ Upstream CESMP; 2019</i>
	SM008	Undertake a feasibility assessment in consultation with local stakeholders on delivering capacity and resilience building programs for Project-affected communities and clan/village leaders, e.g., on financial literacy training and conflict resolution training.	<i>EIS/ Upstream CESMP; 2019</i>
Stakeholder Engagement	SEM002	The Project will prepare an updated stakeholder engagement plan for the Project's construction, operations and decommissioning phases, according to TotalEnergies' General Specifications and IFC PS1 and PS7. The updated stakeholder engagement plan will include the following key requirements: - Regular engagement with PACs on Project impacts, action plans and grievance mechanism. - Notification as early as possible to affected communities in advance of Project works, which describes the activities and how long they are expected to take. Particular focus is to be given to communities affected by PIIM. - A mechanism for enquiries and feedback. - Ongoing grievance and issues management.	<i>EIS/ Upstream CESMP; 2019</i>
	SEM004	Once the Project begins construction, an independent consultant will be engaged to monitor stakeholder engagement and other activities.	<i>EIS/ Upstream CESMP; 2019</i>
Resettlement ⁹	SM031	Resettlement of Pokore Hamlet according to a Resettlement Action Plan (RAP) to be developed and assess social impacts associated with the new location.	<i>EIS Addendum; 2024</i>
Environmental impacts with	EM029	Please see applicable mitigation measures within the following chapters: 6.1 Major Hazards and Infrastructure and Processes	<i>EIS/ Upstream CESMP; 2019</i>

⁹ The need to physically resettle Pokore Hamlet [SM031] is pending further noise assessments. Should physical displacement be necessary, the Project will be required to follow the IFC PS5 on Land Acquisition and Involuntary Resettlement and obtain FPIC from both affected households and, where relevant, host communities (IPF 2026)

Impact	Mitigation code (As in MP)	Description	Source document
adverse effects on land access and livelihoods		• 6.6 Noise and Vibration • 6.7 Soils and Geology • 6.8 Hydrology, Hydrogeology and Water Resources • 6.9 Resource and Waste Management • 6.12 Traffic and Transport • 6.16 Biodiversity - Terrestrial • 6.17 Biodiversity – Freshwater and Estuarine • 6.18 Biodiversity - Marine	

6.15.5 Residual Impacts

For upstream PRL-15 communities, the EIS (2019) and the EIS Addendum (2024) re-evaluated residual social impacts related to land access and asset loss. Table 11.4 of the Addendum states that, after applying the social management measures, residual impacts on access to land and natural resources have been reduced to Minor to Negligible significance.

For the Purari River dredging and barging footprint, the D&B ESIA (2025) includes a residual impact table for social and land-related receptors. For waterways communities, residual risks of injury and property damage from barge wake and vessel interactions are rated as Negligible for Hou Creek and Minor for other waterways after controls on vessel speeds and a prohibition on local crew–community interactions and purchasing are applied. The significance rating for social disruption linked to uneven economic opportunities also has a residual impact rating of Minor.

Residual risks of riverbank erosion, land loss, and loss of associated ecosystem services use at specific villages (e.g., Aivai, Evara, Kaevaria, Poroi 1) are assessed as Minor to Negligible significance when speed controls are enforced. However, the assessment notes that remediation may be needed if non-compliance results in verified damage.

PIIM may contribute to indirect pressures on community health and wellbeing, particularly in settlements with limited baseline services. Increased population density and transient workforce presence can place additional demand on drinking water supply, sanitation infrastructure, and local food systems, potentially exacerbating existing vulnerabilities. While these effects are not solely attributable to the Project and are difficult to quantify at this stage, they are recognised as an important cumulative risk pathway managed through the Project's PIIM controls, Community Health and Safety measures, and livelihood and community development programmes.

For coastal, offshore, and areas at risk of PIIM, residual land and displacement impacts have been described qualitatively (e.g., high-complexity land markets, economic displacement risks, cumulative marine impacts) in this synthesis. However, updated, quantified residual-significance ratings will only be available once the planned LALDPs are completed and the preferred land-access mechanisms are finalised.

Table 6-52 presents residual impacts in relation to livelihoods and displacement.

Table 6-52: Summary of potential residual impacts - Land and livelihoods (Source(s): EIS Social Impacts (2019); EIS Addendum (2024); FEED Changes EAR (2025); Hou Creek Dredging EAR (2025); D&B ESIA (2025))

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / Indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
Land access (permanent and temporary, required by the project)								
Community access to land and resources	Land Access (PRL-15 and PER; excluding CPF, Hou Creek, and borrow pits)	Reduction of livelihood of PAPs living in and around PRL 15 and the PER due to land access (required by the Project)	Direct	PAPs, living in and around PRL-15 and along the onshore PER	C, O	SM001 SM002 SEM003 Also see mitigations relevant to ecosystem services Section 6.19.	Medium/ Low	Minor
Community access to land and resources	Land Access (CPF)	Reduction of livelihood of Pokore Hamlet due to land access (required by the Project)	Indirect	Pokore Hamlet	C, O	SM001 SM002 SEM003 SEM004 SM031	Medium/ Negligible	Negligible
Community access to land and resources	Land access (Hou Creek aggregate dredging)	Reduction of livelihood of PAPs due to land access (required by the project)	Direct	PAPs living in and around Hou Creek Aggregate Dredging.	C, O, D	SM001 SM002 SEM002 SEM003 SEM004	Medium/ Minimal	Negligible
Community access to land and resources	Borrow pit construction and operation	Reduction of livelihood of PAPs due to land access (required by the Project)	Direct	PAPs living in and around PRL-15 and along the onshore export pipeline route	C, O	SM001 SM002 SEM002 SEM003 SEM004	Medium/ Low	Minor
Community access to land and resources	Hou Creek Earthworks (construction) and aggregate extraction and processing (operations)	Short-term disturbance of access to community services, and natural resources	Direct	PAPs, PACs, and local communities along the River transport corridor, i.e., Herd Base to Wabo.	C, O, D	SM001 SM002 SEM002 SEM003 SEM004	High / Minimal	Negligible

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / Indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
Community access to land and resources	Purari River dredging	Short-term disturbance of access to community services, and natural resources	Direct	Pokore Hamlet, Aivai, Poroi 1, Purari Airstrip House, Kaevaria	C	SM001 SM002 SEM001 SEM002 SEM003 SEM004	Medium/Low	Minor
				Ne'ea Creek, Evara		SEM003 SEM004	Medium / Negligible	Negligible
Community access to land and resources	Logistics and transport (barging along the Purari River)	Short-term disturbance of access to community services, and natural resources	Direct	Project-affected and local communities along the main river transport corridor	C, O, D	SM027 SM001 SM002 SEM001 SEM002 SEM003 SEM004	High/ Negligible	Negligible
				Pokore Hamlet		SM027 SM001 SM002 SEM002 SEM003 SEM004 SM031	High/ Negligible	Negligible
Community access to land and resources (coastal)	Caution Bay HDD construction	Short-term disturbance of access to community services, and natural resources (transit to fishing and gleaning grounds)	Direct	Caution Bay	C	SM001 SM002 SEM002 SEM003 SEM004	Medium / Low	Minor
Community access to land and resources (coastal)	Offshore gas pipeline construction	Short-term disturbance of access to community services, and natural resources (traditional fishing)	Direct	Export pipeline route corridor	C	SM001 SM002 SEM002 SEM003 SEM004	Medium / Low	Negligible
Ecosystems services (short term)								

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / Indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
Community livelihoods reliant on ecosystem services	Hou Creek aggregate dredging, planned discharges (e.g., bilge and sewage treatment plant (STP) water)	Reduced livelihood of PAPs due to impacts to aquatic resources	Direct	PAPs, PACs, and local communities along the River transport corridor, i.e., Herd Base to Wabo.	C, O, D	SM002 SEM002 Also see mitigations relevant to hydrology in Section 6.8 freshwater biodiversity in Section 6.17	Medium / Minimal	Negligible
Community livelihoods reliant on ecosystem services	Purari river Dredging (increased turbidity)	Degradation of water leading to impacts to aquatic fauna and subsequent temporary loss of access to food sources	Direct	Poroi 1, Aivai, Apiope, Aumu	C	See mitigations relevant to freshwater and marine wildlife in Section 6.17 and 6.18 and ecosystem services in Section 6.19	Medium / negligible	Negligible
Community livelihoods reliant on ecosystem services	Purari river Dredging (noise and vibration)	Deterrence of fish at dredging sites leading to temporary loss of access to food sources	Direct	Poroi 1, Aivai, Apiope, Aumu	C	See mitigation measures relevant to underwater noise in Section 6.6.9	Medium / Low	Minor
Ecosystem services (long term)								
Community livelihoods reliant on ecosystem services	Purari river Dredging (noise and vibration)	Disruption to fish migration and spawning processes leading to long term loss of access to food sources;	Indirect	Whole of river system	C	See mitigation measures relevant to freshwater biodiversity in Section 6.17 and ecosystem services in Section 6.19	Medium / Low	Minor
Community livelihoods reliant on ecosystem services	Purari river Dredging (changes in river morphology and bank stability)	Erosion of riverbanks and long-term loss of associated land and ecosystem services use	Direct	Whole of river system / all communities	C, O, D	See mitigation measures relevant to reducing wake from river transport in Section 6.12 and ecosystem services in Section 6.19.	Medium / Low	Minor

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / Indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
Community livelihoods reliant on ecosystem services	Purari river dredging and barging (boat traffic)	Erosion of riverbanks and long-term loss of associated land and ecosystem services use	Direct	Aivai, Evara, Kaevaria, Poroi 1,	C, O, D	SM027 Also see mitigation measures relevant to reducing wake from river transport in Section 6.12	Medium / Negligible	Negligible
Community livelihoods reliant on ecosystem services	Purari river Dredging (changes in river morphology and bank stability)	Long-term loss of access to ecosystem services associated with sandbanks	Indirect	Aivai, Evara, Kaevaria, Poroi 1	C, O, D	SM002 SEM002	Medium / Low	Minor
Livelihood assets								
Livelihood dependent assets	Hou Creek aggregate dredging - extraction barges Supply vessels and passenger ferry	Loss or damage of assets due to increased river traffic	Direct	PAPs, PACs, and local communities along the River transport corridor, i.e., Herd Base to Wabo.	C, O, D	SM001 SM002 SEM002 SM027 See also measures relevant river traffic and transport in Section 6.12	Medium / Minimal	Negligible
Livelihood dependent assets	Logistics and transport (dredging and barging along the Purari River)	Loss or damage to assets as a result of increased river traffic	Direct	PACs along the main river transport corridor	C, O, D	SM027 See also measures relevant to river traffic and transport in Section 6.12	Medium/ Low	Minor
			Direct	Pokore Hamlet	C, O, D	SM027 SM031 See also measures relevant to river traffic and transport in Section 6.12	Medium/ Low	Minor
Other economic and social impacts								

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / Indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
Communities along Purari River System	Purari river dredging and barging (Employment and procurement opportunities)	Inappropriate or inequitable distribution of economic opportunities	Direct	Whole of river system / All communities	C, O, D	See mitigation measures relevant to labour and working conditions in Section 6.2.	High / Low	Minor
Communities along Purari River System	Purari river dredging and barging (Employment and procurement opportunities)	Social disruption from uneven access to economic opportunities	Indirect	Whole of river system / All communities	C, O, D	See mitigation measures relevant to labour and working conditions in Section 6.2.	High / Low	Minor
Livelihoods of communities along PER	Rerouting export gas pipeline route	Increase in financial payments and in-kind benefits	Direct and Indirect	PACs in the Kairuku Rural LLG area	C, O, D	SM002 SEM002	Medium / Positive	Positive
Social dynamics of PACs	Hou Creek Aggregate extraction and processing (construction and operations)	Increase in community tension due to disparity in compensation payments	Indirect	Project-affected community, i.e., Meri and Jao'ho clan members	C, O	SM002 SEM002	Medium/ Low	Minor
Communities around PRL-15 and PER	Project employment and procurement.	Improved housing and living conditions.	Indirect	PRL-15 and export pipeline route PAPs.	C, O	SM008	Medium/ Positive	Positive

Notes: C = construction, O = operations, D = decommissioning

6.16 Biodiversity – Terrestrial

6.16.1 Biodiversity Overview

The Project is committed to the ongoing alignment with requirements of IFC PS6, through the construction, operation and decommissioning phases of the Project. In accordance with IFC PS6, the Project applies the mitigation hierarchy to manage biodiversity risks and impacts. This involves first avoiding impacts wherever feasible through project design and siting; minimising impacts that cannot be avoided through the implementation of mitigation measures; restoring or rehabilitating affected habitats following disturbance; and, where significant residual impacts remain, considering biodiversity offsets to achieve no net loss or net gain outcomes, as required.

Avoidance has been favoured by the project where possible (see Section 3.5. on Alternatives). To reduce and minimise impacts, mitigation measures described in this ESHIA Synthesis will be included within the relevant environmental management plans, implemented by the Project and its contractors and monitored throughout by TEP PNG. Where temporary disturbances cannot be avoided, affected habitats will be restored or rehabilitated, where feasible, following construction activities. Should significant residual impacts to natural or critical habitat remain after application of the mitigation hierarchy, the Project will develop and implement appropriate biodiversity offset measures in accordance with IFC PS6 requirements.

To identify the biodiversity aspects of highest conservation value, the Project has undertaken three CHAs and two habitat assessments that align with IFC PS6:

- Terrestrial Critical Habitat Assessment (ERIAS Group, 2025)
- Marine Critical Habitat Assessment (Earth Active, 2025)
- Freshwater Critical Habitat Assessment (Earth Active, 2025).
- Caution Bay Marine Habitat Assessment (Tetra Tech Coffey, 2023)
- Caution Bay Nearshore Marine Habitat Assessment (Tetra Tech Coffey, 2024)

The CHAs confirm that the PAoI occurs within a landscape and seascape of exceptionally high biodiversity value supporting globally significant populations of threatened, endemic, restricted-range and migratory species. To date, 176 species and two ecosystems were identified as meeting IFC PS6 CH criteria, comprising:

- 152 terrestrial species
- 14 freshwater species
- 10 marine species
- Mount Peroro peat forest¹⁰
- The wider Project landscape.

To date, 63 terrestrial species recorded within the Project landscape remain scientifically undescribed, including 48 species considered new to science and first identified during Project surveys. The Purari Basin and associated freshwater systems support endemic fish, reptiles, elasmobranchs and mammals, while the marine environment supports important spawning and nursery habitats for fish and other aquatic species such as the ornate rock lobster and migratory habitats for dolphin and turtle species.

¹⁰ Mount Peroro has been classified as CH qualifying in CHA Summary (2025). However, since the document has been published, there are ongoing discussions that could result in the status being downgraded. The status of Mount Peroro will be confirmed and likely to be updated in further documents.

The Project's Biodiversity and Ecosystem Services Strategy (BESS) describes the Project's overarching objective as: *"To achieve a measurable and long-term Net Gain in Critical Habitat-qualifying features (e.g., species and ecosystems) and to maintain the value and functionality of priority ecosystem services that may be impacted by its operations."*

The strategy for achieving a net gain is described in the BESS and supported by a Biodiversity and Ecosystem Services Action Plan (BESAP), which outlines the composite set of actions required to meet the objectives of the Project's BESS. The Project Residual Impact Assessment (RIA) and Net Gain Feasibility Study (NGFS) have quantified residual impacts and the required gains for the Project to achieve long term, measurable and additional conservation outcomes for the CH-qualifying species and ecosystems. Note that per IFC PS6, CH-qualifying species are those that experience or are predicted to experience significant, adverse residual impacts as a result of project activities.

The RIA concludes that, despite extensive avoidance, minimisation and restoration measures, the Project will result in residual impacts on CH-qualifying biodiversity features. The most important residual impacts relate to the permanent loss and degradation of habitats known to support CH-qualifying species, particularly forest, freshwater and coastal habitats, arising from Project infrastructure, associated edge effects, and indirect pressures linked to PIIM.

At the species level, the RIA/HL-NGFS predict a significant residual impact on 126 of the Project's 176 Critical Habitat-qualifying species. It is these 126 values that require a measurable Net Gain through biodiversity offsets; the remaining 50 species can achieve a Net Gain through additional conservation actions (although gains to these species as a result of the offset programme are also considered likely).

Additional residual impacts are predicted for a range of CH-qualifying fauna within the Project area that are particularly vulnerable to increased hunting and fishing pressure due to PIIM. Particularly sensitive receptors include threatened freshwater and estuarine species, as well as numerous endemic and restricted-range terrestrial species with highly localised distributions. While mitigation measures and restoration commitments substantially reduce impacts, the RIA concludes that residual impacts on CH biodiversity values will remain and will require targeted compensation measures including restoration and biodiversity offsets. Community-based conservation will be one of the main instruments to generate gains. Identifying final offset boundaries will need to be community-driven and collaboratively mapped out between TEP PNG and the relevant community groups, with inputs from species experts and other relevant stakeholders.

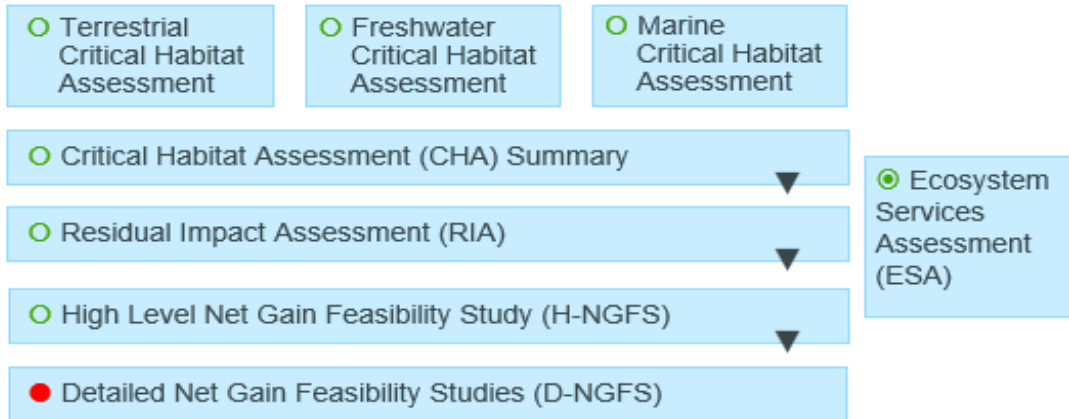
Long term biodiversity monitoring is required to validate the accuracy of predicted impacts and risks to biodiversity by the Project, and the predicted outcomes of the Project's measures to mitigate the impacts and risks described in this ESHIA Synthesis. The Project has therefore also developed a Biodiversity Monitoring and Evaluation Plan (BMEP) which outlines the set of monitoring requirements identified to track the Project's progress towards achieving long term alignment with IFC PS6, including a net gain for CH-qualifying species and ecosystems.

See Figure 6-26 below for biodiversity strategy planning.

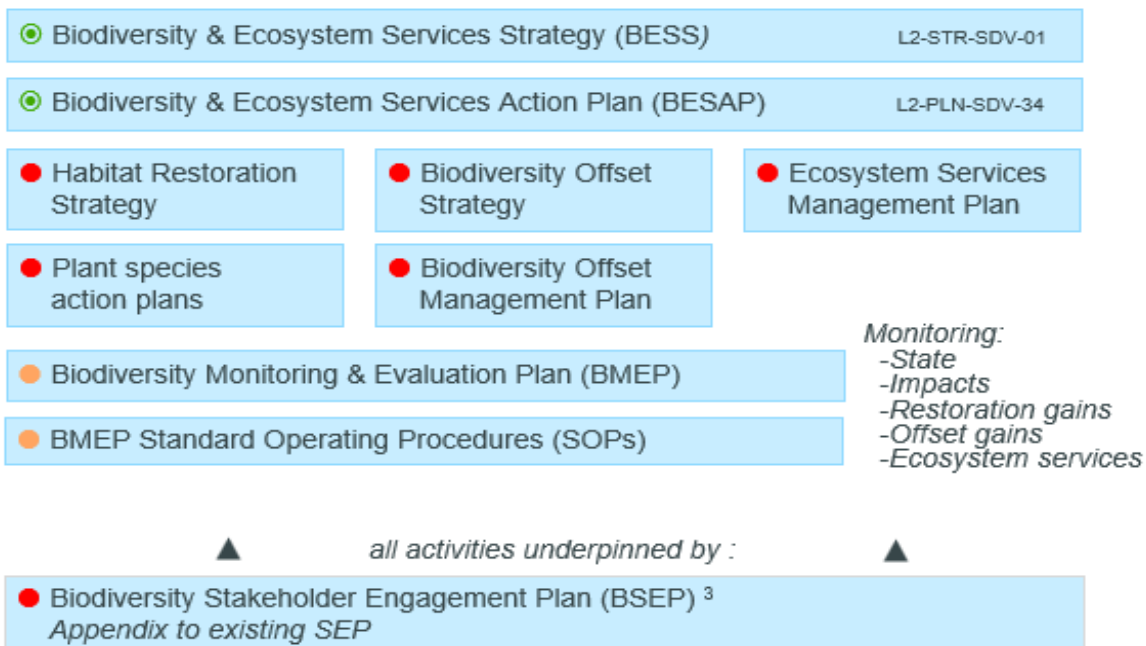
Biodiversity and Ecosystem Services Policy

Net Gain planning and implementation

PS6 studies : Quantifying impacts and offset requirements



Strategies and action plans : Guiding implementation



all activities underpinned by :

● Biodiversity Stakeholder Engagement Plan (BSEP) ³
Appendix to existing SEP

PS6-related documentation: Overview, Hierarchy, Status

- Completed
- Completed and update *ongoing*
- Completed and update *planned*
- Under development
- Planned

Figure 6-26: Existing and planned documentation identified as necessary for designing and developing the Project's biodiversity offset program

6.16.2 Introduction

This section presents a summary of the baseline, impact assessment and mitigation proposed by Project documentation regarding terrestrial biodiversity. See Section 3 for description of the Project footprint. PNG is a highly biodiverse region and supports large numbers of CR, EN, Vulnerable (VU), NT, RR and DD flora and fauna species as categorised by the IUCN Red List. This region supports very highly sensitive and ecologically important habitats (discussed in 6.16.3 below). The Project has the potential to impact biodiversity features throughout its footprint. The assessment of impacts to biodiversity is split into individual sections for terrestrial (Section 6.16), freshwater (Section 6.17) and marine (Section 6.18) biodiversity.

6.16.3 Baseline

PNG is among the most biologically diverse and endemically rich regions on Earth (Olson & Dinerstein, 1998; Brooks et al., 2006; Jenkins et al., 2013; Mittermeier et al., 1997; Wikramanayake et al., 2002). It supports the third largest block of unbroken tropical rainforest in the world and the largest tract of primary rainforest remaining in the Asia-Pacific region (Beehler, 2007; Bryan & Shearman, 2015). Its forests support more than 5% of the world's plant and animal species on less than 1% of its land surface (Faith et al., 2001). As a result, the area of PNG within which the study area is located has featured in multiple global biodiversity priority assessments that identified various high-level values. See Figure 6-27 for an example of the landscape found within PRL-15.



Figure 6-27: Ridge and ravine landform in the northern area of PRL-15 (TEP PNG, 2026)

Terrestrial biodiversity surveys

The following sections are based on baseline survey results outlined in the EIS (2019) and surveys conducted subsequently (i.e. Pre-Clearance Surveys for various Project areas), the findings of which have been summarised in the EIS Addendum (2024), FEED Changes EAR, 2025 and Hou Creek Aggregate Dredging EAR, 2025 and commitments established in the management plans.

The Project's terrestrial biodiversity baseline assessment is focused on the terrestrial environment of the Papua LNG Project. Baseline studies for this Project have been commissioned as part of the EIS (2019) and EBS. These studies have been supplemented with further PCS and a range of additional baseline studies

conducted between 2022 and 2025 to gather additional data and incorporate changes to Project design. Further details on taxonomic groups covered and survey methodology are described below. The key receptors include flora and fauna species (non-volant mammals, bats, avifauna, herpetofauna and odonates (dragonflies and damselflies)), ecosystems and focal sites such as breeding, foraging and other congregatory sites for fauna species. These are described in further detail in Table 6-53 below.

Table 6-53: Survey techniques for different taxa groups

Survey method	Vascular plants	Non-volant mammals	Bats	Birds	Herpetofauna	Odonates
Visual searches	x	x	x	x	x	x
Audial detection		x	x	x	x	
Mist-nets			x	x		
Harp traps			x			
Camera traps		x		x		
Snap-traps		x				
Elliot traps		x				
Hand nets			x			x
Sound recording				x	x	
Sound playback				x		
Ultrasonic call recording			x			
Specimen collection	x	x	x	x	x	x
Informal interviews with local landowners		x	x	x	x	x

Table 6-54 below summarises the biodiversity studies undertaken for different terrestrial ecological receptors across the project footprint and impact areas since 2016.

Table 6-54: Summary of biodiversity surveys undertaken

Survey Date	Survey Location	Ecological receptors surveyed
2016	PRL-15, upper Era River catchment area, Purari river catchment area, Middle Purari Hills ecological zone, Mena basin headwaters, Southeast Coast and Southeast Hills ecological zone, proposed CPF location, logistics base and airstrip area; oxbow lakes, Delta Swamps and Plains ecological zone (near the Middle Purari Hills boundary), Kuku creek catchment area, Herd Base, Hou Creek base, export pipeline corridor, Orokolo Bay foreshore, coastal plain and Paevera Hills, Evara Village, Poroi 1 Village, Mapaio Fish Camp, Village, Aivai Village, Avavu Village, Wabo Village, Subu 2 Village, Oru/Hururu Villages, Kavava/Mareke Villages, Harevavo/Marea Villages, Antelope 1, 2 and 3 wellpad clearings, Elk 1 and 2 wellpad clearings, Purari airstrip, Wabo airport terminal, Abandoned logging road at Aivai koki (east bank of the Purari River opposite Aivai village); active logging road and skid tracks leading to the Evara logging camp at Site 3; abandoned logging roads and log landings near the dieback site; logging road near the Purari airstrip; and the abandoned logging road through the Site 7 camp	Flora and fauna, sensitive habitats, local communities and camps for ecosystem services and local knowledge
2019	R03, CPF P3	Flora and fauna

February 2022	Road R05 chainage 0 to chainage 9300, R05 Chainage 0 to chainage 2000, spoil disposal site, CPF P3, Herd Base, Trunkline (TL04) and new spoil disposal area (SP02), R03	Flora and fauna, sensitive habitats, ecosystem condition, pests and weeds
2023	CPF P3, Camps 2 and 3, Road R03 hill crossing, Road R03 infill surveys, Spoil disposal sites R05-03, R05-04, R05-06, R05-09, R05-11, R05-12, R05-13, R05-15	Flora and fauna
2024	R05 infill areas	Flora and fauna, sensitive habitats, pests and weeds, ecosystem condition

Figure 6-28 below shows an example of the terrestrial biodiversity baseline mapping undertaken in the vicinity of the CPF and Herd Base.

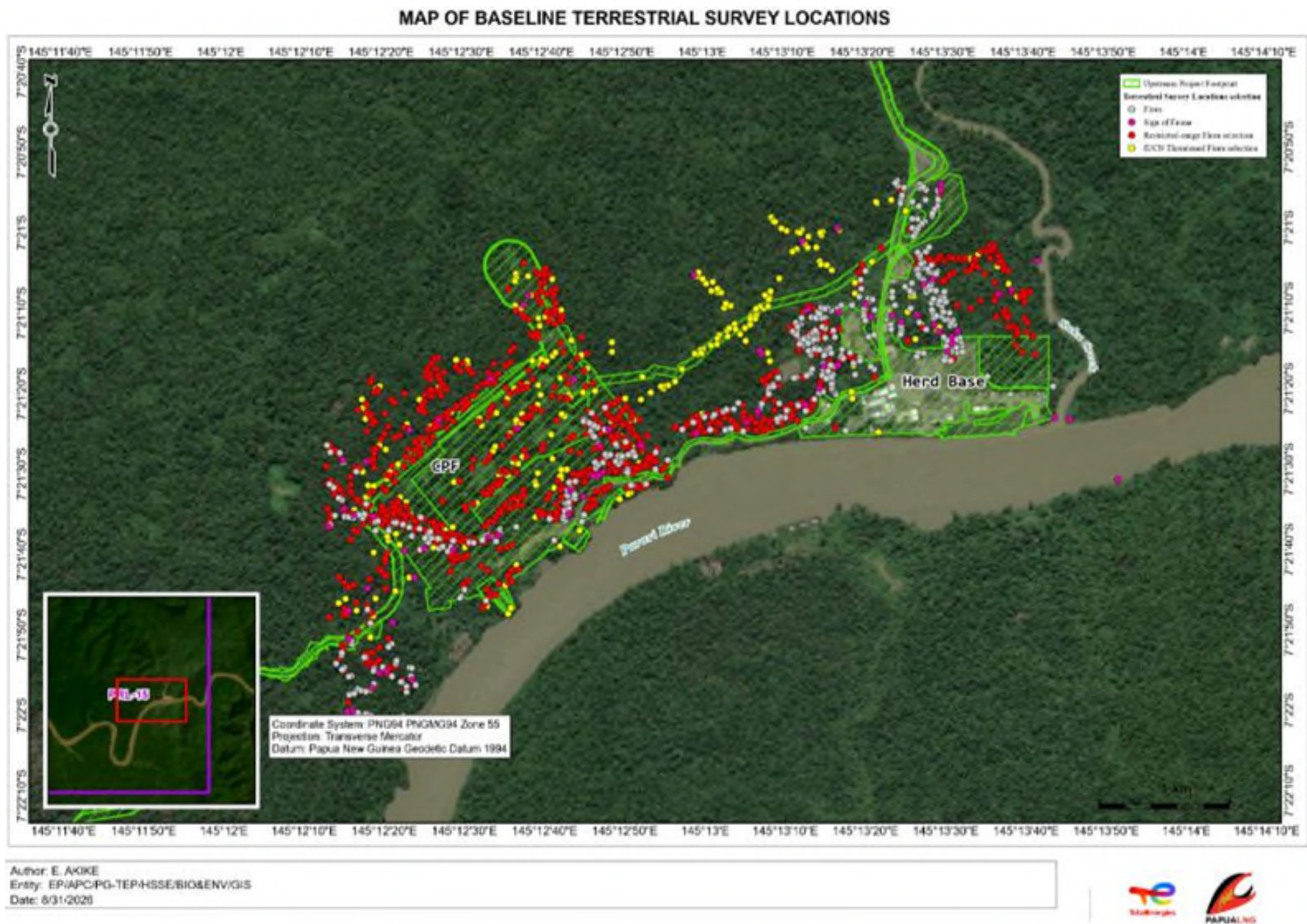


Figure 6-28: Example of terrestrial biodiversity baseline mapping in the vicinity of the CPF and Herd Base (source: TEP PNG, 2026)

See images Figure 6-29, Figure 6-30 and Figure 6-31 for example of species of conservation importance that were identified during the surveys.

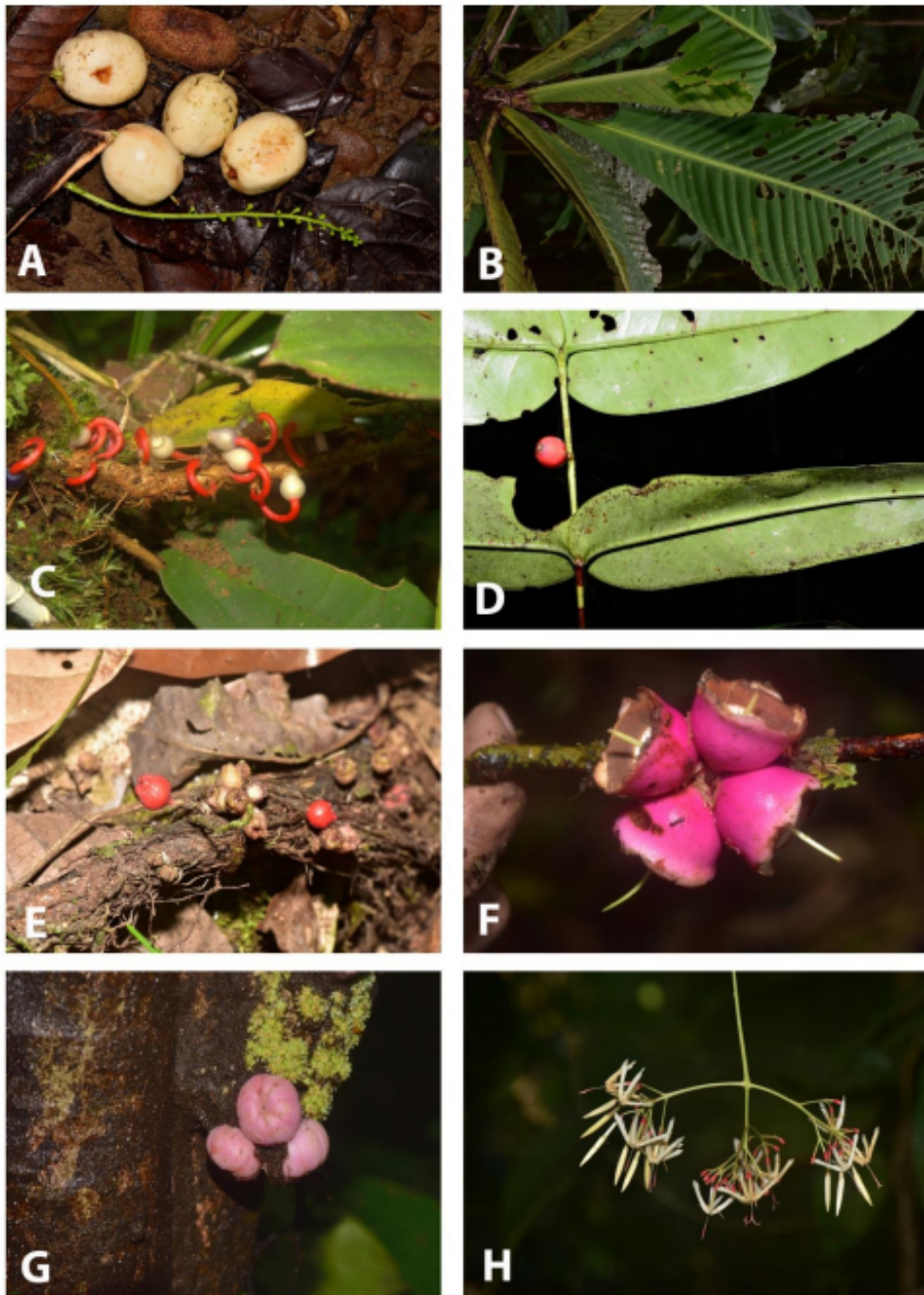


Figure 6-29: New (N) and undescribed (U) flora species. A . *Barringtonia* sp.1(N); B. *Barringtonia* sp.2(N); C. *Medinilla* sp.1(N); D. *Memecylon* sp.1 (U); E *Ficus* sp.1 (N); F. *Syzygium* sp. 1(N); G. *Glochidion* sp.1 (N); H. *Ixora* sp.1 (N) (Source: EIS Impacts, Terrestrial, 2019)



Family Carettochelyidae. *Carettochelys insculpta*.
IUCN Vulnerable. © S. J. Richards



Family Trionychidae. *Pelochelys bibroni*.
IUCN Vulnerable. © S. J. Richards



Family Colubridae. *Stegonotus* sp. 1. New-to-science



Family Gekkonidae. *Gehyra* sp. 1. New-to-science



Family Scincidae. *Sphenomorphus* sp. 1. Undescribed

Figure 6-30: New to science, undescribed and reptile species of conservation importance (Source: EIS Impacts, Terrestrial, 2019)

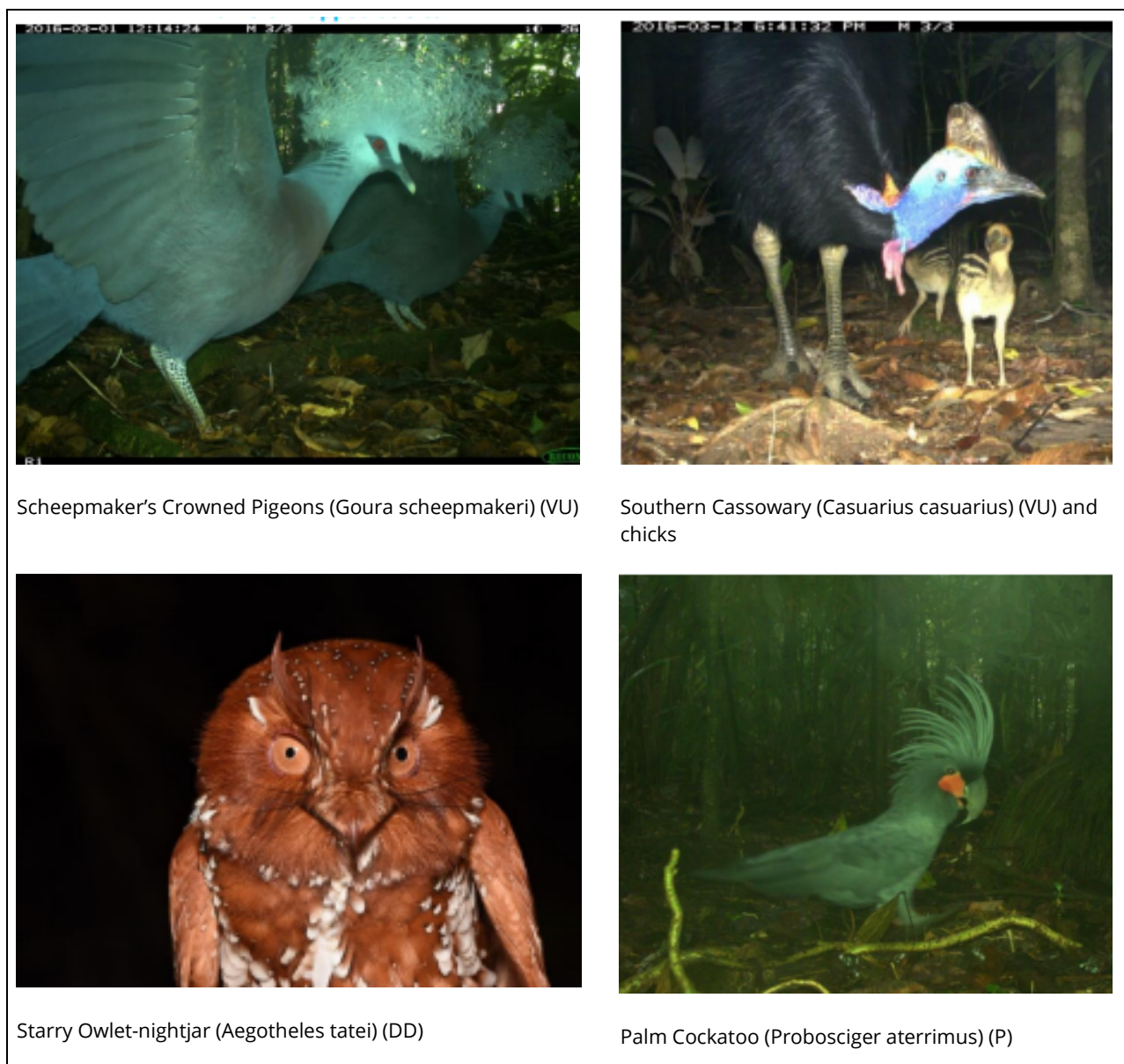


Figure 6-31: Avian species of conservation importance (Source: EIS Impacts, Terrestrial, 2019)

Terrestrial EAAA

For the purposes of the EIS (2019), a terrestrial biodiversity study area was defined that covers 734,080 ha, and “contains continuous extensions of those ecosystems and habitats present within the PAoI and is considered likely to support viable populations of most or all resident species whose distributions overlap Project components”. The same study area boundaries were then applied when the Project developed its Terrestrial CHA (2025), with the addition of the upper slopes of Aure Scarp. The objective of the CHA is to identify the areas of the highest biodiversity value in line with IFC PS6 Critical Habitat criteria, as follows:

- Critical Habitat Criterion 1: CR and EN species
- Critical Habitat Criterion 2: RR species
- Critical Habitat Criterion 3: Migratory and congregatory species
- Critical Habitat Criterion 4: Highly Threatened or unique ecosystems
- Critical Habitat Criterion 5: Key evolutionary processes

Under IFC PS6, projects are required to apply a set of specific mitigation measures when operating in areas of Critical Habitat (see Paragraphs 17 to 19 of IFC PS6), and for all ecosystems, species or protected areas that qualify as Critical Habitat, the Project is required to demonstrate a Net Gain.

As part of developing a CHA, it is a requirement to define 'ecologically appropriate area of analysis -' (EAAAs). These are defined by the distributions of candidate species or ecosystems assessed under Criterion 1 to 4 and are determined according to 'the ecological patterns, processes, features and functions that are necessary for maintaining them' (IFC, 2019, GN59). For the purpose of the Terrestrial CHA (2025), nine terrestrial EAAAs were identified that cover all parts of the PAoI and broader Project landscape spanning 729,007 ha. They are defined according to the distribution of vegetation, landforms, elevation, major catchments and areas of marine tidal influence. The terrestrial EAAAs are presented in Figure 6-32 below.

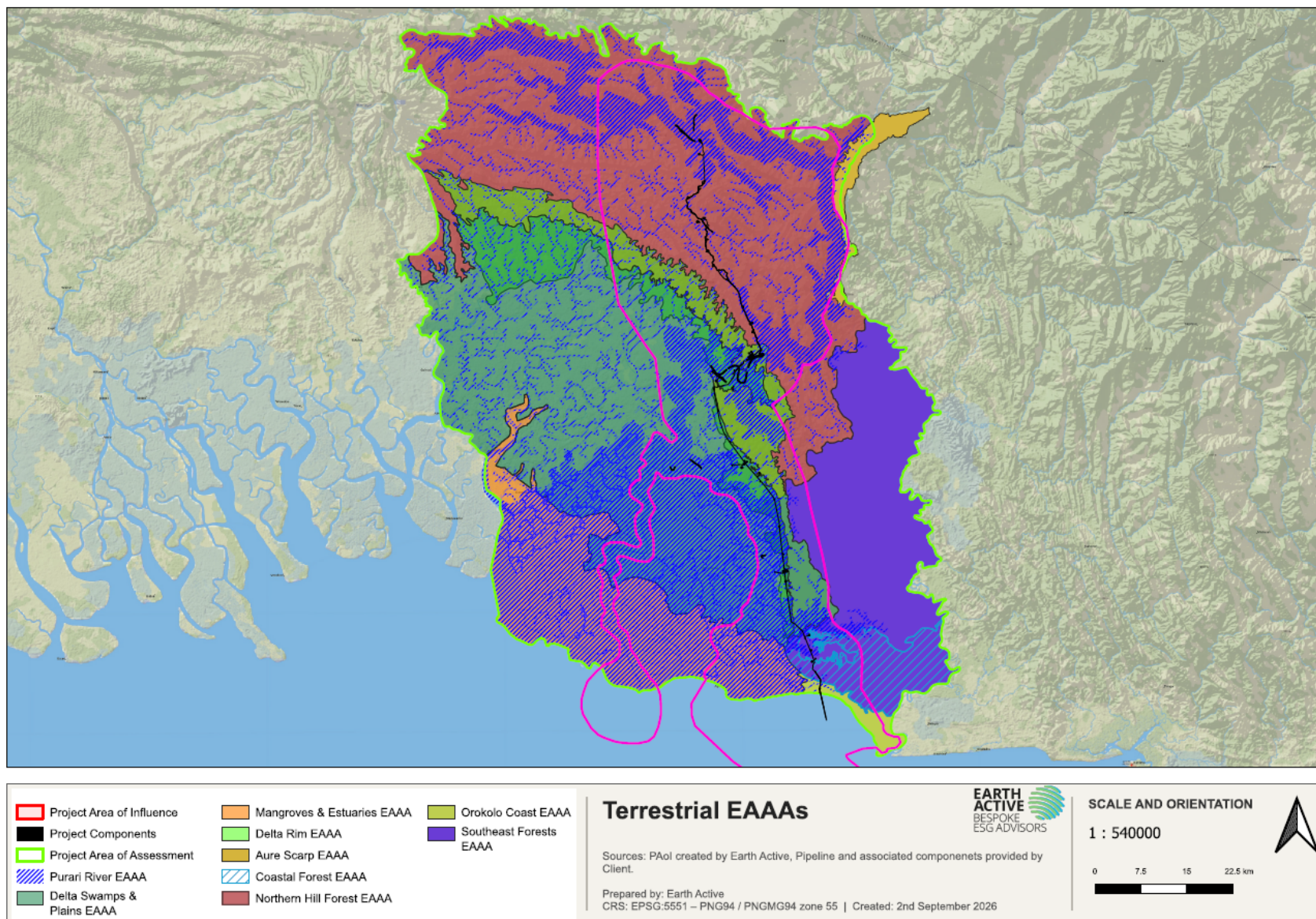


Figure 6-32: Terrestrial EAAAs . (Source: Earth Active Ltd, 2026)

Vegetation Types

The terrestrial upstream area is covered almost entirely in natural vegetation (98.9%), including primary (old growth forests) and secondary (forest that have regrown after a major disturbance, usually comprising of younger trees) forest types. Vegetation patterns are strongly shaped by landform, hydrology, geology and tidal influence, resulting in a diverse mosaic of forest and wetland communities arranged across five ecological zones. In total, 33 natural vegetation types are recognised, grouped into seven broad vegetation groups: hill forest, freshwater swamp forest and woodland, alluvial forest, mangrove forest, herb/grassland swamp, lower montane forest and littoral forest. This diversity of structurally and floristically distinct vegetation types underpins the high terrestrial biodiversity values of the region.

The EIS (2019) identified five broad vegetation groups (BVGs) as present within the upstream area:

- Hill forest – the most extensive vegetation group, covering more than 3,400km² and 48.7% of the study area and dominating the uplifted terrain of the Middle Purari Hills (MPH) and Southeast Hills (SH). These forests are floristically rich and structurally complex, typically supporting closed canopies 25–30 m in height with emergent trees reaching 40 m on fertile and stable substrates. On shallower or less fertile soils, canopy height and emergent frequency decline, but species diversity remains high. The hill forests of the northern Upstream Area, including PRL-15, are largely intact and form part of a broad, contiguous tract of lowland rainforest that supports numerous endemic and restricted-range plant species, including several taxa newly described from Project surveys.
- Alluvial forest – occurring on recent depositional landforms in areas that are well drained or periodically inundated, alluvial forest is concentrated within the Delta Swamps and Plains (DSP) ecological zone, with additional occurrences in the SH and Southeast Coast (SC). It frequently forms vegetation complexes (50–80% dominance) with freshwater swamp vegetation. In its various forms, including complexes, it covers more than 1,160 km² (16.6%) of the study area. These forests are tall and floristically rich, with structure influenced by drainage patterns and soil characteristics. Canopies are often irregular and gap-rich, supporting dense understories of saplings, palms, pandanus, gingers, lianas and epiphytes. These dynamic floodplain systems contribute to high habitat heterogeneity and support key ecological processes linked to the Purari and Vailala river systems.
- Freshwater swamp vegetation (swamp forest) – the second most widespread BVG, covering nearly 1,800 km² (approximately 25.6% of the study area), freshwater swamp vegetation occurs in areas subject to frequent, seasonal or permanent inundation. It is most extensive across the composite levee plains of the Delta Swamps and Plains and along the interior margins of the Mangroves ecological zone, particularly within poorly drained interfluvial backplains. Additional occurrences are present within the Purari and Vailala River catchments in the Southeast Hills. These swamp forests are important for endemic amphibians, wetland-dependent fauna, and ecosystem services such as water regulation and carbon storage. The Mount Peroro peat forest, located southeast of PRL-15, represents a particularly important swamp forest ecosystem.
- Mangroves – Mangrove forest (mangal) comprises salt-tolerant plant communities growing in coastal, estuarine and riverine environments subject to regular tidal inundation and sheltered from heavy wave action. Mangroves cover approximately 603.6 km² of the study area, with 97.9% occurring within the Mangroves ecological zone and minor extensions into the Southeast Coast (11.6 km²) and Delta Swamps and Plains (1.1 km²). Although plant species diversity is lower than in inland rainforest systems, these mangrove ecosystems form part of the larger Gulf of Papua deltaic complex and perform critical ecological functions, including shoreline stabilisation, nutrient cycling and habitat provision for migratory and congregatory species. Their intact condition is an important contributor to the ecological integrity of the coastal landscape.

- Littoral forest – this vegetation grows on dry sandy beach ridges and plains and comprises a succession of vegetation types. The only mapped occurrences of this BVG in the study area are found in 1.8 km² of coastal habitats (e.g., beach ridges and plains).

Protected Areas

Crater Mountain Wildlife Management Area (CMWMA)

The Crater Mountain Wildlife Management Area (CMWMA) is a nationally declared protected area under PNG legislation and lies along the northern margin of the Upstream Area. The CMWMA covers approximately 270,000 ha, of which around 23,648 ha overlap with the PAoI, including approximately 12 km² within PRL-15. No Project facilities are currently located on land within the CMWMA and there is to be no construction of Project components within the protected area.

The CMWMA is recognised internationally as a Key Biodiversity Area (KBA) due to the presence of species of global conservation concern and its role in maintaining intact upland–lowland ecological gradients. Its proximity to the Upstream Area reinforces the regional ecological connectivity of the broader Kikori–Purari landscape. The overlap occurs primarily within intact hill forest systems that form part of a contiguous forest tract extending northwards toward New Guinea’s central cordillera.

Other Protected Areas Near the Study Site

Two additional protected or internationally recognised areas occur within the wider terrestrial landscape but lie outside the Upstream PAoI:

- Neiru Aird Hills Wildlife Management Area, located approximately 50 km from the upstream PAoI.
- The Kikori River Basin Great Papuan Plateau, located approximately 15 km from the upstream PAoI.

While not directly intersecting the Project footprint, these areas contribute to the broader regional conservation context. The Upstream Area forms part of the eastern half of the Kikori–Purari biogeographic region and retains ecological connectivity with these adjacent high-value landscapes.

Other Areas of High Biodiversity Importance

Mt. Peroro Peat Forest

In 2022, botanists conducting PCSs identified a previously undocumented peat forest ecosystem on Mount Peroro, approximately 4 km southeast of PRL-15. Peat forest is extremely rare in PNG, undocumented in the formal scientific literature, and not assigned a Forest Inventory Mapping System (FIMS) code. Only two other peat forest occurrences have been recorded nationally, both identified during industry-supported surveys elsewhere in PNG.

Preliminary assessment indicates that the Mount Peroro peat forest is floristically distinct from other recorded peat systems, suggesting it may represent a unique ecological community. In addition to its botanical distinctiveness, the peat forest likely performs important ecosystem services, including long-term carbon storage, hydrological regulation and provision of specialised habitat for endemic flora and wetland-dependent fauna. Its rarity at both national and potentially global scales elevates its conservation importance within the Upstream Area.

PRL- 15 Oxbow Wetlands

The ‘PRL-15 oxbow wetlands’ system covers approximately 25km² and contains the largest lake system present in the Project landscape. It includes multiple lakes of varying size, surrounding areas of permanently and frequently inundated vegetation and two minor watercourses (Nea Creek and Djo’boh Creek) that link the oxbow lake system with the Purari River. Interconnecting vegetated swamps have substantial water exchange with the open water lake environments. The oxbow lakes and associated vegetated swamps provide important habitat for a variety of resident, migratory and congregatory bird species and are

important breeding habitats for the Hall's New Guinea crocodile (*Crocodylus halli*), the estuarine crocodile (*C. porosus*) and for small freshwater turtle species. The PRL-15 oxbow wetlands supported the largest congregations of waterbirds observed during the ESBS (2017) baseline surveys (including more than 250 egrets).

Sensitive Species

Of the plant and animal species recorded to date in the terrestrial study area, 63 remain scientifically undescribed, including 48 species discovered for the first time during Project surveys and considered new to science, and a further 15 species that had previously been recognised but remain formally undescribed. The Terrestrial CHA (2025) confirms 152 species and two biodiversity features as meeting the thresholds for Critical Habitat Criterion 1, 2, and 3. The lowland rainforests of the Project area support a very high proportion of regionally endemic and restricted-range species (mainly plants, frogs and odonates). The Purari River catchment is known to support extremely high levels of endemism.

Subsequent to the EIS Addendum (2024), the Project footprint was expanded to include the Hou Creek base area. Given this the Hou Creek Aggregate Dredging EAR (2025) has identified the inclusion of three more rare plant species with one of few known individuals or populations recorded in or near proposed Project footprints, not previously assessed: *Begonia* sp. 17, *Begonia* sp. 18, and *Cyrtandra* sp. 4.

Invasive Alien Species

During the surveys conducted for the EIS (2019), 97 invasive and alien plant species were identified within the Project footprint of which seven are priority 1 (those species that can persist in unmodified native ecosystems, have the potential to cause ecosystem degradation by displacing native species or negatively impact on regeneration or rehabilitation measures) and 34 are priority 2 (those species that can persist in disturbed areas and are unlikely to persist without some anthropogenic influence) species. The PCS surveys conducted between 2022-2025 identified a further 48 species of which 14 are priority 1, and 5 which are priority 2 species. Two invasive animal species were recorded in the PAoI which were not listed in the ESBS (2017). These are the coconut rhinoceros beetle (Priority 2; *Oryctes rhinoceros*) and Asian house gecko (Priority 3; *Hemidactylus frenatus*).

6.16.4 Impact Assessment

Despite effort made to avoid sensitive areas during design and routing options, potential impacts may occur on sensitive receptors. The impact assessment undertaken in EIS Vol. 1 Ch. 11 Impacts Terrestrial (2019) assessed Project-direct, indirect and cumulative impacts to terrestrial biodiversity. This was updated in the EIS Addendum (2024) to include impacts for the following receptor sensitivity ratings: Very high (of which six plants were found), 73 high sensitivity species and 119 medium sensitivity species. Potential Impacts occurring due to Project activities during the construction and operations phases are summarised below (FEED Changes EAR (2025), D&B ESIA (2025), Hou Creek Aggregate Dredging EAR (2025), and EIS (2019)):

- Habitat loss and fragmentation, including loss of important features and impacts from barrier effects.
- Habitat degradation, including impacts from edge effects, erosion and movement of soil and spoil, sedimentation and contamination of waterways, reduction in air quality, fire, deforestation and acid rain.
- Loss of focal features.
- Natural regeneration failure following vegetation clearing.
- Loss of individuals and populations.
- Mortality or injury to fauna, including from vehicle strike and impacts from trenching.

- Disturbance to fauna and focal breeding and roosting sites; for example, through noise, vibration and light emissions.
- Introduction and spread of invasive alien species, including weeds, pests and pathogens.
- Loss of watercourses and wetland habitats.
- Erosion and movement of soil in terrestrial environments.
- Sedimentation of waterways and changes to hydrology.
- Contamination of terrestrial and aquatic environments.
- Reduction in air quality.
- Unplanned and uncontrolled fires.
- Impacts to terrestrial biodiversity from induced changes to the livelihoods and subsistence activity patterns and from population influx, including increasing hunting, exploitation of forest resources and clearing of land for housing and gardens.
- Edge effects: In 2019, 100 m and 150 m buffers were used to define the area degraded by edge effects from facility/infrastructure clearings that were less than 150 m wide and greater than 150 m wide, respectively. In the EIS Addendum (2024) assessment, the buffer has been precautionarily increased to 200 m for all Project clearings, irrespective of width.
- Barrier effects: the CPF location may pose an increased risk of barrier effects for the flora, fauna and ecosystems of the Purari River's hinterland. For those species that do rely on riverside vegetation, connectivity along the riverbank habitat will be further interrupted, over and above the existing barrier provided by Herd Base. However, it is anticipated that these effects will be local in scale and will not seriously impact access to riparian habitats for local flora and fauna populations, nor measurably impact the viability of any local flora and fauna population.

Potential cumulative impacts to terrestrial biodiversity were identified in the EIS (2019) and have been described further in Section 7 below on Cumulative Impacts.

6.16.5 Mitigation

Proposed mitigation and management measures are as outlined in the EIS (2019). The various PCS reports and EIS Addendum (2024) provide additional site-specific context for some of the recommendations made more broadly in the EIS (2019), including:

- Plant species to be used for rehabilitation at each site.
- Individual priority plants, large trees, large fig trees, trees with large hollows, megapode nest mounds, hill forest pools, pandanus swamps and other sensitive species or focal sites to be retained in position where practical.

Table 6-55 outlines mitigation measures in relation to terrestrial biodiversity:

Table 6-55: Mitigation measures - Terrestrial biodiversity

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
Habitat loss	EM001	Avoidance / Minimisation	All sites proposed for development as part of the Project will be subject to a preconstruction survey to clearly identify acid sulphate soils, sensitive sites and habitats, e.g. roosting, breeding, nesting and threatened species sites, priority ecosystem services, archaeological sites, burial sites, sites of religious importance to be subject to specific mitigation measures.	<i>EIS/ Upstream CESMP; 2019</i>
	EM024	Minimisation/ Restoration	Maintain a minimum practical distance from sensitive features to minimise potential degradation and disturbance. Buffer distances shall be ecologically relevant, considering: • Sensitive habitats, i.e. primary alluvial forest, mangroves, riparian vegetation along forest streams. • Habitats that provide focal breeding, roosting or feeding sites for sensitive fauna, e.g. caves, rock shelters, rock outcrops, large trees with hollows, large trees with nests, bird-of-paradise display trees, forest pools, large fig trees (<i>Ficus</i> spp.) and vines of the family Aristolochiaceae. • Sites that support populations of IUCN Threatened or rare and localised plant species.	<i>EIS/ Upstream CESMP; 2019</i>
Forest degradation and destruction	EM002	Restoration	Progressively clear vegetation and rehabilitate cleared areas as soon as practicable to minimise the time cleared areas are exposed; and allow fauna to move away from areas to be cleared, where practicable.	<i>EIS/ Upstream CESMP; 2019</i>
	EM025	Minimisation	Minimise damage to habitat surrounding planned footprints by safely felling trees into planned footprints or into less environmentally sensitive natural spaces between standing trees.	<i>EIS/ Upstream CESMP; 2019</i>
	EM029	Restoration	Actively or passively rehabilitating bare sites as soon as possible to promote a stable self-sustaining landscape. E.g., • Allow forest edges to naturally regenerate or create appropriate conditions to facilitate natural regeneration, e.g. rip the substrate, replace topsoil, apply mulch • Rehabilitate Pandanus habitats, e.g. recreate mounds, re-instate the intertidal surface between Pandanus mounds. • Rip compact surfaces across the slope, as appropriate, to facilitate revegetation and minimise erosion. • Spread stockpiled topsoil, organic matter and cleared vegetation over the rehabilitation area to promote natural regeneration. • Use native vegetation to revegetate sites when active rehabilitation measures are required.	<i>EIS/ Upstream CESMP; 2019</i>
	EM041	Minimisation	Implement dust control, where required.	<i>EIS/ Upstream</i>

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
				CESMP; 2019
Unplanned and uncontrolled fires	EM018	Minimisation	An Emergency Response Plan will be developed to effectively manage the preparedness and response to emergency events. It will contain: - Site contingency plans, that will consider fire management measures. - An Oil Spill Contingency Plan, that will consider spill risks for construction, operation and decommissioning of facilities and associated infrastructure, and supply services on land and in aquatic and marine environments. - A Blow Out Contingency Plan including well blowout control and contingency measures.	EIS/ Upstream CESMP; 2019
	EM026	Avoidance	Avoid burning cleared vegetation, wherever practicable.	EIS/ Upstream CESMP; 2019
	EM027	Avoidance	Project personnel, workers, contractors or third-party operators, while engaged in Project activities, will be prohibited: - To light and use fire except for specific work requirements controlled under the 'Hot Works' permit procedure and in designated smoking areas. - To hunt, fish, collect or disturb forest or wildlife resources. - To possess hunting or fishing equipment, including firearms, bow and arrows, spears, rubber guns, slingshots and other hunting tools. - To keep pets or to purchase, acquire or possess any wildlife or wildlife products.	EIS/ Upstream CESMP; 2019
	EM028	Avoidance / Minimisation	All Project personnel, workers, contractors and 3rd party operators will be educated during inductions and safety training about: - Fire risks, including the heightened risk during extreme drought years and smoking. - Wildlife values. - Weed, pathogen and animal pest hygiene and control measures. - Identification of cultural heritage, cultural heritage awareness, measures for avoiding impacts and the Chance Finds Procedure.	EIS/ Upstream CESMP; 2019
Contamination and degradation of	EM011	Minimisation	Water from trenches will be discharged in accordance with applicable water quality standards with erosion and sediment controls where relevant.	EIS/ Upstream CESMP; 2019

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
wetland habitat	EM012	Minimisation	Maintain buffer zones between permanent surface water and project infrastructure, except to carry out works associated with the construction of watercourse crossing or where facilities are proposed to be located within that buffer.	<i>EIS/ Upstream CESMP; 2019</i>
	EM030	Minimisation	Dispose of excess spoil material from Project earthworks in designated spoil disposal sites.	<i>EIS/ Upstream CESMP; 2019</i>
Natural regeneration failure	EM002	Minimisation / Restoration	Progressively clear vegetation and rehabilitate cleared areas as soon as practicable to minimise the time cleared areas are exposed; and allow fauna to move away from areas to be cleared, where practicable.	<i>EIS/ Upstream CESMP; 2019</i>
	EM003	Minimisation	Cut trees where practicable to retain the rootstock and maintain soil stability.	<i>EIS/ Upstream CESMP; 2019</i>
	EM005	Minimisation	Stabilise spoil stockpiles and areas of ground disturbance as soon as practicable after initial disturbance using, e.g., mulched vegetation, aggregates and soil binders.	<i>EIS/ Upstream CESMP; 2019</i>
	EM009	Restoration	Backfill trenches as soon as practicable after disturbance, using material originally excavated from the trench as much as possible. The backfilled trenches should not exceed the preconstruction levels after the material has settled.	<i>EIS/ Upstream CESMP; 2019</i>
	EM023	Minimisation	Management controls will be developed for weed, pathogen and pest that pose a significant threat to biodiversity, including: • Specific risk-based control methods, and procedures targeting Priority 1 and 2 weeds and pest fauna. • A quarantine management program for moving people, equipment and supplies in accordance with PNG law. • Tools for field personnel to identify Priority 1 and 2 weeds and pest fauna.	<i>EIS/ Upstream CESMP; 2019</i>
	EM029	Minimisation	See above	<i>EIS/ Upstream</i>

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
				<i>CESMP; 2019</i>
	EM030	Minimisation	Dispose of excess spoil material from Project earthworks in designated spoil disposal sites	<i>EIS/ Upstream CESMP; 2019</i>
Weed establishment in rehabilitation areas	EM023	Minimisation	See above	<i>EIS/ Upstream CESMP; 2019</i>
Loss of individuals or population of forest flora and fauna from project activities and hunting by project workers	EM001	Avoidance / Minimisation	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM002	Restoration	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM027	Avoidance	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM028	Avoidance / Minimisation	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM031	Minimisation	Use a suitably trained fauna handler to relocate fauna, where practicable, before vegetation clearing.	<i>EIS/ Upstream CESMP; 2019</i>
	EM032	Restoration	When a significant impact remains on IUCN Threatened species or rare and localised plant species, translocation and propagation shall be considered when ecologically feasible.	<i>EIS/ Upstream</i>

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
				CESMP; 2019
	EM033	Minimisation	Develop Traffic and Transport Management controls that include: - Posting speed limits on Project roads via posted speed limit signs. - Requiring vehicles to keep to posted speed limits. - Keeping vehicles and mobile machinery to marked trafficable areas and work sites.	EIS/ Upstream CESMP; 2019
	EM041	Minimisation	See above	EIS/ Upstream CESMP; 2019
Loss of specialist feeding plants	EM001	Avoidance / Minimisation	See above	EIS/ Upstream CESMP; 2019
	EM024	Minimisation	See above	EIS/ Upstream CESMP; 2019
Reduction in the population of IUCN threatened freshwater turtles	EM022	Minimisation	Implement lower speeds past aquatic fauna when observed in the water.	EIS/ Upstream CESMP; 2019
	EM024	Minimisation	See above	EIS/ Upstream CESMP; 2019
	EM049	Minimisation	Develop and implement a comprehensive IUCN Threatened Freshwater Turtle Species Management Program, that will: - Engage with Piku Biodiversity Network (PNG non-government organisation (NGO)) and/or other ecologists as required. - Educate/train and engage local resident landowners in an effort to curb currently unsustainable hunting levels. - Initiate studies into the location and timing of nesting and to document harvesting rates.	EIS Addendum; 2024

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
			Monitor local populations.	
	EM050	Minimisation	Targeted baseline studies will be undertaken to better understand the ecology and population status of the study area's IUCN threatened freshwater turtles and the harvesting practices of local residents. These studies will be undertaken prior to construction and will be followed by long-term monitoring of breeding and harvesting activity. The results of these studies may lead to amendment of or addition to existing mitigation measures.	<i>EIS Addendum; 2024</i>
New-to-science plants with one of few known populations in or near Project footprints and regionally rare IUCN Threatened timber trees: Loss of only known plant individual (<i>Syzygium</i> sp. 1 and 4) or one or more of few known individuals	EM032	Restoration	When a significant impact remains on IUCN Threatened species or rare and localised plant species, translocation and propagation shall be considered when ecologically feasible.	<i>EIS/ Upstream CESMP; 2019</i>
	EM013	Minimisation	Minimise in-stream and stream bank disturbance during high rainfall.	<i>EIS/ Upstream CESMP; 2019</i>
Injury to or mortality of forest fauna from vehicle strike and	EM009	Restoration	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM033	Minimisation	See above	<i>EIS/ Upstream</i>

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
being trapped in trenches				<i>CESMP</i> ; 2019
	EM034	Minimisation	Install ramps, e.g. unexcavated or backfilled earth plugs, in the pipeline trench at regular intervals and at other high-risk locations to permit fauna to exit.	<i>EIS/ Upstream CESMP</i> ; 2019
	EM035	Minimisation	Visually inspect open trenches and excavations in the morning and evening and use a suitably trained fauna handler to remove trapped wildlife, where practicable.	<i>EIS/ Upstream CESMP</i> ; 2019
Disturbance to or loss of IUCN Threatened freshwater turtle river bank and crocodile nest sites and nest failure	EM024	Minimisation	See above	<i>EIS/ Upstream CESMP</i> ; 2019
	EM033	Minimisation	See above	<i>EIS/ Upstream CESMP</i> ; 2019
	EM014	Minimisation	Implement low speed limits through areas sensitive to vessel wash.	<i>EIS/ Upstream CESMP</i> ; 2019
	EM033	Minimisation	See above	<i>EIS/ Upstream CESMP</i> ; 2019
	EM049	Minimisation	See above	<i>EIS Addendum</i> ; 2024
	EM050	Minimisation	See above	<i>EIS Addendum</i> ; 2024

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
Loss of tree-hollow or cave roosting bats from loss of breeding or roosting sites	EM046	Minimisation	Limit construction work, where practicable, to daytime hours.	<i>EIS/ Upstream CESMP; 2019</i>
Loss of individual migratory shorebirds, resident marine coastal birds and freshwater wetland birds and disturbance to feeding or roosting congregations and breeding sites	EM019	Minimisation	Vessels will be required to have shipboard Oil Pollution Emergency Plans/Oil Spill Contingency Plans as per TotalEnergies' requirements and Marine Pollution (Ships and Installations) Act 2013.	<i>EIS/ Upstream CESMP; 2019</i>
Loss of congregatory bats and birds and disturbance to feeding or roosting congregations and breeding sites	EM024	Minimisation	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM027	Avoidance	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM028	Avoidance / Minimisation	See above	<i>EIS/ Upstream</i>

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
				<i>CESMP; 2019</i>
	EM046	Minimisation	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM047	Avoidance	Avoid directly lighting areas at night and minimise fixed night lighting for safe operations, e.g., direct lighting away from the Purari Airstrip House, and the surrounding forest.	<i>EIS/ Upstream CESMP; 2019</i>
Introduction and spread of invasive alien pests, weeds and pathogens	EM023	Minimisation	See above	<i>EIS/ Upstream CESMP; 2019</i>
Weed invasion and rapid establishment in rehabilitation areas leading to poor or failed regeneration of native forest vegetation	EM023	Minimisation	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM029	Minimisation	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM036	Restoration	Where possible, separate and stockpile cleared topsoil (with the inherent seed bank and any coarse woody debris) to use for future rehabilitation.	<i>EIS/ Upstream CESMP; 2019</i>

6.16.6 Residual Impacts

The most significant terrestrial habitat losses are forests (predominantly Hill Forest which is the most abundant terrestrial habitat type in the landscape). The Project components resulting in the main losses are the pipelines and their RoWs which will largely be rehabilitated. Other important contributing components include roads, wellpads, the CPF and the various construction camps. All of the forest habitat types set to be impacted are understood to support Critical Habitat-qualifying fauna and flora. See Table 6-55 for a summary of the Project residual impacts, which summarises findings from the EIS Impacts Terrestrial (2019), FEED Changes EAR (2025), EIS Addendum (2024), D&B ESIA (2025) and Hou Creek Aggregate Dredging EAR (2025).

Where significant impacts may remain despite mitigation and particularly for sensitive plants, an additional mitigation has been developed: If losses are unavoidable, prior to removing any plants: (1) collect suitable propagation material, and (2) demonstrate successful propagation of numbers to over-compensate losses, or (3) survey beyond proposed footprints to locate additional populations that, according to expert opinion, would provide sufficient propagation material to overcompensate for projected losses.

In addition, the supplementary RIA (2025) was carried out by Earth Active Ltd, which used a wider range of biodiversity metrics and was designed to specifically support the Project in quantifying biodiversity losses and setting biodiversity net gain targets in line with IFC PS6 and other standards of good practice for biodiversity loss / gain accounting. This RIA applied a quality-hectare approach, which assessed the extent of the Critical Habitat-qualifying habitats and ecosystems set to be impacted, as well as their condition at the point of Project impact. This was carried out using a standardised scoring framework used to calculate habitat and ecosystem condition values. Quality hectare (Qha) scores were then calculated by *area x condition*.

For species whose on-site abundance can be reliably estimated (including extrapolating as necessary and scientifically justifiable), the number of individuals was used. For species whose on-site abundance cannot be reliably estimated but abundance is believed to be proportional to habitat area and quality, a species-specific Qha was used. For those species which are set to be residually impacted by hunting/fishing due to activities undertaken by resident communities, an impact-weighted habitat score * area (in 'Impact Quality hectares' IQha) where the impact from hunting/fishing is modelled using the methods outlined in RIA (2025).

A Net Gain Feasibility Study (2025) was also completed, that has identified a range of biodiversity net gain targets (also in Qha), based on the findings of the RIA (2025), selected to compensate for the Project's residual losses to terrestrial Critical Habitat-qualifying features.

Table 6-56: Summary of potential residual impacts – Terrestrial biodiversity (Source(s): EIS Impacts Terrestrial (2019); EIS Addendum (2024), Hou Creek Aggregate Dredging EAR, (2025))

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
Ecosystems							
Primary hill forest	Vegetation clearing for construction of facilities and infrastructure; operation and decommissioning activities	Habitat loss and fragmentation; habitat degradation; fire; introduction and spread of invasive alien species	PRL-15; export pipeline route	C, O, D	EM001	Medium/Low	Minor
Primary alluvial forest			Export pipeline route		EM002	High/Low	Moderate
Logged alluvial forest					EM003	Medium/Low	Minor
Primary swamp forest					EM005	Medium/Low	Minor
Swamp woodland; low freshwater swamp vegetation					EM011	Medium/Low	Minor
Mangrove					EM012	Medium/Low	Minor
Riverine seral forest	Transfer of equipment and personnel by boat; forest resource use	Habitat degradation	River transport corridor		EM018	High/Minimal	Minor
					EM041	Medium/ Minimal	Negligible
					EM023		
					EM024		
					EM025		
					EM026		
				EM027			
				EM028			
				EM029			
				EM030			
EM036							
SM028							
SM030							
Protected Areas							
Crater Mountain Wildlife Management Area	In-migration	Habitat loss and fragmentation; habitat degradation; loss of individuals and populations; introduction and spread of invasive alien species; hunting	Pawaian villages (outside of Project areas)	C, O, D	See above	High/Minimal	Minor
Focal Sites							

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/Magnitude	Significance
Caves - general	Quarrying; disturbance of breeding and roosting colonies	Habitat loss and fragmentation; loss of individuals and populations; damage or destruction of feeding breeding nesting and roosting sites	PRL-15	C, O, D	EM001	High/Minimal	Minor
Caves - Wi'i Creek site					EM027	Very High/Minimal	Minor
Other rock shelters					EM028 SM028 SM030	Medium/Minimal	Negligible
Large trees Large fig trees Hill forest pools	Vegetation clearing for construction of facilities and infrastructure	Habitat loss and fragmentation; loss of individuals and populations; loss of focal features	PRL-15, export pipeline route	C, O, D	EM001 EM018 EM024 EM025 EM026 EM027 EM028 EM041	Medium/Low	Minor
Forest Species: Primary Hill Forest (and Alluvial and/or Swamp Forest in Some Cases) Plants							
Very High sensitivity species, MPH, DSP and northern SH <i>Dolicholobium rufiflorum</i>	Vegetation clearing for construction of facilities/ infrastructure; operation and decommissioning activities.	Loss of individuals and habitat; degradation of remaining habitat; weed infestation; fire; reduction in population viability	PRL-15 and/or proposed export pipeline route	C, O, D	EM001 EM002 EM004 EM013 EM018 EM023 EM024 EM025 EM026 EM027 EM028	Very High/Low	Moderate

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/Magnitude	Significance
High sensitivity species MPH only, or predominantly MPH and DSP rim or northern SH <i>Dischidia</i> sp.1; <i>Calamus</i> sp. 1; <i>Licuala</i> sp. 1; <i>Begonia</i> sp. 4; <i>Begonia</i> sp. 13; <i>Begonia</i> sp. 16; <i>Mammea grandifolia</i> ; <i>Archidendron</i> sp. 1; <i>Litsea globosa</i> ; <i>Medinilla</i> sp. 1; <i>Syzygium</i> sp. 3; <i>Syzygium</i> sp. 5; <i>Syzygium</i> sp. 7; <i>Bulbophyllum</i> sp. 1; Bamboo sp. 2; <i>Fittingia</i> sp. 1; <i>Maschalodesme</i> sp. 3; <i>Rhadinopus</i> sp. 1; <i>Etlingera</i> sp. 8					EM030 EM031 EM032 [†] EM033 EM041	High/Low	Moderate

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/Magnitude	Significance
High sensitivity species MPH only, found only at Aure Scarp, east of the Purari River and PRL-15 <i>Dracontomelon lenticulatum</i>						High / Minimal	Minor

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/Magnitude	Significance
Medium sensitivity species MPH only, or predominantly MPH and DSP rim or northern SH <i>Semecarpus</i> sp. 1; Annonaceae sp. 1; <i>Orophaea</i> sp. 1; <i>Calypetrocalyx</i> sp. 1; <i>Calypetrocalyx</i> sp. 2; <i>Ptychosperma</i> sp. 1; <i>Saribus pendulinus</i> ; <i>Begonia</i> sp. 1; <i>Begonia</i> sp. 3; <i>Begonia</i> sp. 9; <i>Begonia</i> sp. 10; <i>Begonia</i> sp. 12; <i>Mammea novoguineensis</i> ; <i>Hopea iriana</i> ; <i>Vaccinium</i> sp. 1; <i>Cyrtandra</i> sp. 1; <i>Cyrtandra</i> sp. 2 ; <i>Barringtonia</i> sp. 1; <i>Syzygium</i> sp. 8; <i>Glochidion beehleri</i> ; Bamboo sp. 3; <i>Maschalodesme</i> sp. 1; Sapindaceae sp. 1; <i>Alpinia</i> sp. 1; <i>Alpinia</i> sp. 2; <i>Etlingera</i> sp. 1; <i>Etlingera</i> sp. 3; <i>Etlingera</i> sp. 4; <i>Riedelia</i> sp. 1; <i>Riedelia</i> sp. 2						Medium / Low	Minor

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/Magnitude	Significance
Medium sensitivity species MPH only found only at Aure Scarp east of the Purari River and PRL-15 <i>Saurauia</i> sp. 3; <i>Elaeocarpus amplifolius</i> ; <i>Elaeocarpus miegei</i> ; <i>Dysoxylum alatum</i> ; <i>Palaquium warburgianum</i>						Medium / Minimal	Negligible
High sensitivity species SH and MPH (and DSP in some cases) <i>Anisoptera thurifera</i> ; <i>Diospyros lolinopsis</i> ; <i>Endospermum medullosum</i> ; <i>Barringtonia</i> sp. 3; <i>Pterocymbium beccarii</i> ; <i>Syzygium</i> sp. 2; <i>Ixora</i> sp. 3;						High / Minimal	Minor
Medium sensitivity species SH and MPH (and DSP and SC in some cases) <i>Codiaeum tenerifolium</i> ; <i>Barringtonia</i> sp. 2; <i>Syzygium</i> sp. 4; <i>Eumachia purariensis</i> ; <i>Ixora</i> sp. 1; <i>Ixora</i> sp. 4; <i>Ixora</i> sp. 5; <i>Maschalodesme</i> sp. 4; <i>Etlingera</i> sp. 2; <i>Etlingera</i> sp. 5						Medium / Minimal	Negligible
Very High sensitivity species not recorded during Project surveys <i>Myristica brachypoda</i>						Very High / Minimal	Minor

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
High sensitivity species not recorded during Project surveys <i>Marsdenia venusta</i> ; <i>Koompassia grandiflora</i> ; <i>Gmelina sessilis</i> ; <i>Endiandra cyphellophora</i> ; <i>Endiandra latifolia</i>						High / Minimal	Minor
Medium sensitivity species not recorded during Project surveys <i>Goniothalamus aruensis</i> ; <i>Cryptocarya massoy</i>						Medium / Minimal	Negligible
Forest Species: Disturbance Tolerant Hill Forest (and Alluvial and/or Swamp Forest in Some Cases) Plants							
High sensitivity species SH (and MPH/DSP in most cases) <i>Archidendron forbesii</i> ; <i>Ficus</i> sp. 1	Vegetation clearing for construction of facilities/ infrastructure; operation and decommissioning activities.	Loss of individuals and habitat; degradation of remaining habitat; weed infestation; fire; reduction in population viability	PRL-15 and/or proposed export pipeline route	C, O, D	See above	High / Minimal	Minor
Medium sensitivity species SH and MPH (and DSP in some cases) <i>Miliusa</i> sp. 1; <i>Intsia bijuga</i> ; <i>Adinandra forbesii</i> ; <i>Bridelia macrocarpa</i> ; Bamboo sp. 1; <i>Helicia latifolia</i>						Medium / Minimal	Negligible
Forest Species: Primary Alluvial and Swamp Forest Plants							
High sensitivity species <i>Pseuduvaria</i> sp. 1 <i>Oberonia</i> sp. 1	Vegetation clearing for construction of facilities/ infrastructure;	Loss of individuals and habitat; degradation of remaining habitat; weed infestation; fire;	PRL-15 and/or proposed export pipeline route	C, O, D	See above	High / Low	Moderate

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
Very High sensitivity species not recorded during Project surveys <i>Psychotria heterophylla</i>	operation and decommissioning activities.	reduction in population viability				Very High / Minimal	Minor
High sensitivity species not recorded during Project surveys <i>Calophyllum suberosum</i> ; <i>Eleutherostylis renistipulata</i> ; <i>Pandanus rex</i> ; <i>Ixora whitei</i>						High / Minimal	Minor
Forest Species: Plants – Mangrove (and/or Freshwater) Swamp Forest							
<i>Bulbophyllum</i> sp. 2	Transfer of equipment and personnel by boat; forest resource use	Loss of individuals; contamination of wetland habitat; habitat degradation	River transport corridor; coastal shorefront	C, O, D	See above	High / Minimal	Minor
High sensitivity species not recorded during Project surveys <i>Avicennia rumphiana</i> ; <i>Glochidion delticola</i>						High / Minimal	Minor
Medium sensitivity species not recorded during Project surveys <i>Sonneratia ovata</i>						Medium / Minimal	Negligible

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
New-to-science and Other Very Rare Plants with One of Few Known Populations in or Near the Project Footprint							
Begonia sp. 14	Vegetation clearing for construction/ upgrade of facilities/ infrastructure; dumping of spoil; operation and decommissioning activities;	Loss of only known individual; degradation of remaining habitat; weed infestation; fire; threat to population viability	Gas field (Road R07)	C, O, D	EM001 EM013 EM018 EM024 EM025 EM026 EM027 EM028 EM032† EM041	Very High / Medium	Major
Phaleria sp. 1			Export pipeline route			High / Medium	Moderate
Begonia sp. 17		Loss of all five of the only known populations; degradation of remaining habitat; weed infestation; fire; threat to population viability	Hou Creek base			High / Medium	Moderate
Begonia sp. 18		Loss of the two known populations; degradation of remaining habitat; weed infestation; fire; threat to population viability	Hou Creek base			High / Medium	Moderate
Cyrtandra sp. 4		Loss of habitat at the only known site; degradation of remaining habitat; weed infestation; fire; threat to population viability	Hou Creek base			High / Medium	Moderate

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
<i>Pandanus pendulinus</i>		One of only two known sites already partly developed with some habitat lost; possible loss of additional individuals; degradation of remaining habitat; weed infestation; fire; threat to population viability	Road R05/trunkline			High / Medium	Moderate
<i>Begonia</i> sp. 5		Loss of most of <5 known sites/ populations (via vegetation clearance, edge effects, loss or contamination of watercourses and associated riparian habitat, or erosion/sedimentation of stream-side habitat); degradation of remaining habitat; weed infestation; fire; threat to population viability	CPF P3 site, Road R05/trunkline			Very High / Low	Moderate
<i>Etlingera</i> sp. 6						High / Low	Moderate
<i>Orania longistaminodia</i>						Very High / Low	Moderate
<i>Begonia</i> sp. 2; <i>Begonia</i> sp. 11; <i>Syzygium</i> sp. 1		Loss of one or more of few known	Gas field, Road R05, Road R07			High / Low	Moderate

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
<i>Discocalyx</i> sp. 1		individuals/populations; degradation of remaining habitat; weed infestation; fire; reduction in population viability	Road R05, Road R07, export pipeline route			Medium / Low	Minor
<i>Medinilla</i> sp. 2		Loss/degradation of suitable habitat near the only known site (600 m from the CPF P3 site and associated infrastructure)	CPF P3 site			High / Low	Moderate
<i>Pseuduvaria</i> sp. 2		Loss of one or more of few known individuals/populations; degradation of remaining habitat; weed infestation; fire; reduction in population viability	Export pipeline route			High/Low	Moderate
<i>Garcinia</i> sp. 1**			Road R05. export pipeline route			High/Low	Moderate
<i>Lasianthus</i> sp. 1			Gas field (Road R07), CPF–Herd Base area			High / Minimal	Minor
Forest Species: Fauna - Hill Forest (and Alluvial and/or Swamp Forest in Some Cases)							
Birdwing butterflies MPH only: goliath birdwing (<i>Ornithoptera goliath</i>); paradise birdwing (<i>O. paradisea</i>)	Vegetation clearing for construction of facilities/ infrastructure; operation and decommissioning activities.	Loss of habitat; loss of specialist feeding plants; invasive alien species; fire	PRL-15	C, O, D	EM001 EM002 EM023 EM024 EM027 EM028 EM041	Medium / Low	Minor
Birdwing butterflies all ecological zones other than Mv: Southern tailed birdwing (<i>Ornothoptera meridionalis</i>)			All Project areas except mangroves and coastal			Medium / Minimal	Negligible
Tree hollow/cave roosting bats (all ecological zones): Papuan free-tailed bat (<i>Otomops papuensis</i>); Papuan sheath-tailed bat (<i>Saccolaimus mixtus</i>)	Vegetation clearing for construction of facilities/ infrastructure;	Loss of individuals and/or breeding/roosting sites; fire; loss of foraging habitat; reduction in	PRL-15, proposed export pipeline route		EM001 EM002 EM027 EM028	Medium / Minimal	Negligible

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
	operation and decommissioning activities; quarrying; hunting	population viability			EM031 EM046 EM047 SM028 SM030		
Medium sensitivity mammal species MPH only (and DSP rim in some cases): New Guinea quoll (<i>Dasyurus albopunctatus</i>); Woolley's three-striped dasyure (<i>Myoictis leucura</i>)	Vegetation clearing for construction of facilities/ infrastructure; operation and decommissioning activities; hunting	Loss of individuals and habitat; degradation of remaining habitat; weed infestation; fire; reduction in population viability	PRL-15		EM001 EM002 EM009 EM027 EM028 EM031	Medium / Low	Minor
Medium sensitivity bird species MPH and SH (and DSP rim in several cases): Gurney's eagle (<i>Aquila gurneyi</i>); Blyth's hornbill (<i>Rhyticeros plicatus</i>); palm cockatoo (<i>Probosciger aterrimus</i>); glossy-mantled manucode (<i>Manucodia ater</i>); crinkle-collared manucode (<i>M. chalybatus</i>); trumpet manucode (<i>Phonygammus kaurene</i>); magnificent riflebird (<i>Ptiloris magnificus</i>); magnificent bird-of-paradise (<i>Diphyllodes magnificus</i>); king bird-of-paradise (<i>Cicinnurus regius</i>); Raggiana bird-of-paradise (<i>Paradisaea raggiana</i>)			PRL-15 and proposed export pipeline route		EM033 EM034 EM035 EM046 EM047 SM028 SM030	Medium / Minimal	Negligible
Medium sensitivity reptiles MPH only: <i>Sphenomorphus brunneus</i>			PRL-15			Medium / Low	Minor

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
Medium sensitivity reptiles MPH and SH: <i>Gehyra</i> sp. 1; <i>Nactus papuana</i>			PRL-15, proposed export pipeline route			Medium / Minimal	Negligible
Medium sensitivity microhylid frogs MPH only: <i>Austrochaperina</i> sp. 2; <i>Choerophryne crucifer</i>			PRL-15			Medium/Low	Minor
Medium sensitivity microhylid frogs MPH and SH (and DSP and other zones in some cases): <i>Callulops marmoratus</i> ; <i>Cophixalus hannahae</i> ; <i>Copiula mosbyae</i> ; <i>Oreophryne</i> sp. 1;			PRL-15 and proposed export pipeline route			Medium / Minimal	Negligible
Forest Species: Fauna - Alluvial and/or Foothill Forest							
High sensitivity species DSP and limited MPH and/or SH: <i>Stegonotus aplini</i>	Vegetation clearing for construction of facilities/ infrastructure; operation and decommissioning activities; hunting	Loss of individuals and habitat; degradation of remaining habitat; weed infestation; fire; reduction in population viability	PRL-15 and proposed export pipeline route	C, O, D	See above	High / Low	Moderate
Medium sensitivity species DSP and limited MPH and/or SH: starry owllet-nightjar (<i>Aegotheles tatei</i>)						Medium / Low	Minor
High sensitivity species: <i>Cophixalus</i> sp. 3; <i>Oreophryne</i> sp. 2; <i>Argiolestes tuberculiferus</i> ; <i>Pyrrhargiolestes angulatus</i> ; <i>Teinobasis caelestis</i> ; <i>Teinobasis fragillima</i> ; <i>Nososticta purari</i> ; <i>Rhyacocnemis gassmanni</i> ; <i>Palaeosynthemis papilio</i>	Vegetation clearing for construction of facilities/ infrastructure; operation and decommissioning activities.	Loss of individuals/populations (via vegetation clearance, edge effects, loss or contamination of watercourses and associated riparian habitat, or erosion/ sedimentation of stream-side habitat); degradation of remaining habitat;	PRL-15 and/or proposed export pipeline route	C, O, D	EM001 EM002 EM004 EM009 EM018 EM023 EM027 EM028 EM031 EM033	High / Low	Moderate
Medium sensitivity species: forest bittern (<i>Zonerodius heliosylus</i>); <i>Litoria exophthalmia</i> ; <i>Litoria sauroni</i> ; <i>Litoria</i> sp.						Medium / Low	Minor

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
1; <i>Papurana arfaki</i> ; <i>Papurana</i> sp. 2; <i>Metagrion trigonale</i> ; <i>Teinobasis aurantiaca</i> ; <i>Teinobasis debeauxi</i> ; <i>Bironides ypsilon</i> ; <i>Diplacina cyrene</i> ; <i>Idiocnemis milou</i> ; <i>Idiocnemis patriciae</i> ; <i>Nososticta boonei</i> ; <i>Nososticta paraconifera</i> ; <i>Nososticta smilodon</i> ; <i>Nososticta truncata</i> ; <i>Drepanosticta taurulus</i>		weed infestation; fire; reduction in population viability			EM034 EM035 EM046 EM047		
Odonates present in open and disturbed habitats: <i>Agyrtacantha</i> sp. 1; <i>Papuagrion forceps</i>						Medium / Minimal	Negligible
Forest Species: Fauna - Alluvial and/or Foothill Forest							
High sensitivity species: false water rat (<i>Xeromys myoides</i>) (id. uncertain)	Vegetation clearing for construction of facilities/ infrastructure; transfer of equipment and personnel by boat; other operation and decommissioning activities; forest resource use	Loss of individuals/habitat; contamination of wetland forest habitat; habitat degradation	All Project areas	C, O, D	See above	High / Minimal	Minor
Medium sensitivity species: blue-black kingfisher (<i>Todirhamphus nigrocyaneus</i>); twelve-wired bird-of-paradise (<i>Seleucidis melanoleucus</i>)						Medium / Minimal	Negligible
Hunting-sensitive Fauna							
High sensitivity species: lowland tree kangaroo (<i>Dendrolagus spadix</i>); Scheepmaker's crowned pigeon (<i>Goura scheepmakeri</i>)	Hunting (indirect impacts); vegetation clearing for construction of	Loss of individuals and habitat; degradation of remaining habitat; weed infestation; fire; reduction in population	PRL-15 and/or proposed export pipeline route	C, O, D	EM002 EM004 EM009 EM024	High/Low	Moderate

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/Magnitude	Significance
Medium sensitivity species: southern cassowary (<i>Casuarius casuarius</i>)	facilities/ infrastructure; operation and decommissioning activities	viability			EM027 EM028 EM031 EM033 EM034 EM035 EM046 EM047 SM028 SM030	Medium/Low	Minor
Grey dorcopsis (<i>Dorcopsis luctuosa</i>); Papuan eagle (<i>Harpyopsis novaeguineae</i>); Pesquet's parrot (<i>Psitttrichas fulgidus</i>)						High/Minimal	Minor
Hall's New Guinea crocodile (<i>Crocodylus halli</i>); estuarine crocodile (<i>C. porosus</i>)	Hunting and harvesting of eggs by local population and/or Project workforce; transfer of equipment and personnel by boat	Adult population reduction; nest failure; damage to/loss of nest sites; weed infestation	PRL-15; river transport corridor		EM014 EM022 EM023 EM024 EM027 EM028	Medium / Low	Minor
Migratory/congregatory Shorebirds							
High sensitivity species: far eastern curlew (<i>Numenius madagascariensis</i>); great knot (<i>Calidris tenuirostris</i>)	Dredging near the coast; transfer of equipment and personnel by boat;	Loss of individuals; disturbance to feeding or roosting congregations	River transport corridor; coastal shorefront	C, O, D	EM019 EM027 EM028	High/Minimal	Minor

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase*	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
Medium sensitivity species: Asian dowitcher (<i>Limnodromus semipalmatus</i>); black-tailed godwit (<i>Limosa limosa</i>); bar-tailed godwit (<i>L. lapponica</i>); grey-tailed tattler (<i>Tringa brevipes</i>); red knot (<i>Calidris canutus</i>); red-necked stint (<i>C. ruficollis</i>); curlew sandpiper (<i>C. ferruginea</i>)	hunting	impacting on energy reserves required for migration			EM046 EM047	Medium / Minimal	Negligible
Resident marine coastal birds							
Eastern osprey (<i>Pandion cristatus</i>); beach stone-curlew (<i>Esacus magirostris</i>)	Transfer of equipment and personnel by boat; hunting	Loss of individuals; disturbance at breeding sites	River transport corridor; coastal shorefront	C, O, D	See above	Medium/ Minimal	Negligible
Freshwater Wetland Birds							
Great egret (<i>Ardea alba</i>); intermediate egret (<i>Egretta intermedia</i>); little egret (<i>E. garzetta</i>)	Transfer of equipment and personnel by boat; construction, operation and decommissioning of facilities and infrastructure; hunting	Disturbance at feeding/roosting sites; contamination of watercourses and associated riparian habitat	River transport corridor; coastal shorefront; PRL-15	C, O, D	See above	Medium/ Minimal	Negligible

Notes: C = construction, O = operation, D = decommissioning.

* Project phase in this table describes activities for the whole Papua LNG Project

** Following taxonomic research, *Mammea* sp. 1 has undergone a name change to *Garcinia* sp.

6.17 Biodiversity – Freshwater and Estuarine

6.17.1 Introduction

This section presents a synthesis of Project documentation relating to freshwater and estuarine biodiversity. This includes a summary of the activities undertaken to assess Project-impacts on freshwater habitats, fauna and flora, in accordance with IFC PS6. It builds on baseline survey results outlined in the EIS (2019) and a range of freshwater baseline surveys conducted since, including an eDNA survey in the Purari River and aquatic baseline gathered as part of PCS.

6.17.2 Baseline

Freshwater and Estuarine Surveys

Field surveys and desktop analysis were first conducted in June (Purari River delta, Purari River estuary and Vaihua River estuary sites) and July (Purari River tributary sites) 2016 and then again in January (Purari River delta, Purari River estuary and Vaihua River estuary sites) and February 2017 (Purari River tributary sites). Sampling activities included:

- Validation of aquatic biotope mapping.
- Site-based semi-quantitative and qualitative characterisation of the biophysical features of aquatic biotopes.
- Semi-quantitative surveys of aquatic macroinvertebrate assemblages inhabiting riffle, littoral (edge) and pool hydraulic habitat units in accordance with the AusRivAS (Australian Rivers Assessment System) methodology (AGDE 2000). Macroinvertebrate collection was undertaken using dip nets when in wadable waterways and a Van Veen grab from a vessel when in non-wadable waterways.
- Quantitative sampling of fish and macrocrustacean assemblages using nets, traps and electrofishing equipment. Electrofishing was the preferred sampling technique for wadable waterways while all other sample techniques were used as required. Overnight deployment of gill nets occurred at some larger pool sites.
- Collection of fish and prawn samples for laboratory analysis of a suite of metals, metalloids and PAHs.

As part of the studies conducted for the D&B ESIA (2025), eDNA surveys were carried out in 2023 from eleven sites in the Lower Purari River and near the mouth of the river. None of the target species, including sawfish, river sharks, and various river dolphin species, were detected. One IUCN EN turtle species and six nationally protected fish and ray species previously identified in the EIS (2019) were recorded in the eDNA surveys.

eDNA surveys were conducted again in 2025. The results were useful in providing evidence of species presence, however, due to sample errors they were partly compromised. It was therefore not possible to determine other indicators such as species abundance or distribution, or whether occurrence differences detected across the different sampling areas represent ecological changes or if they are an artifact of sample quality. There was however strong evidence to suggest the presence of one EN turtle species that has been previously recorded in surveys and literature as being present in this region.

Three field surveys were also undertaken to supplement existing information on marine and upstream hydrodynamics, sediment and water quality, aquatic species, macrobenthic ecology and marine fauna presence. These were undertaken in June, July and September 2023.

Table 6-57: Freshwater surveys undertaken between 2016 till date

Survey Date	Survey Location	Ecological Receptors Surveyed
2016	PRL-15 and Upper and Lower Purari River Delta, Vaihua River Estuary, Caution Bay, PRL-15 oxbow lakes, southern plateau and northern plateau, mangrove ecological zone	Fish and macroinvertebrates, aquatic biotopes (biophysical features; mangrove/aquatic vegetation), Benthic aquatic macroinvertebrates, Fish and prawn tissue (metals, metalloids and PAHs). Mangrove and intertidal habitats
2017	PRL-15 and Upper Purari River Delta, Vaihua River Estuary, Caution Bay, Purari River tributary sites, Nea Creek at Mapaio fish camp, the Kapuna boat wharf and herbaceous swamps at Kapuna, and the oxbow wetland (aerial observation only), Mangroves of the Purari delta and Orokolo Bay	Fish and macroinvertebrates, aquatic biotopes (biophysical features; mangrove/aquatic vegetation), aquatic macroinvertebrates. Fish and prawn tissue (metals, metalloids and PAHs)
2019	R03, Waterways within Road R03, Tributaries within PRL-15 and downstream to the coast, CPF P3 waterways	Fish and macroinvertebrates
2022	Waterways within R03, CPF P3 waterways, Herd Base Expansion Survey Area, PRL-15, Gulf Province - sites CHB1 to CHB4 on defined waterways associated with the expansion area, Road R05 chainage 0 – 9300, Spoil disposal sites R05-09, R05-11, R05-12, R05-13, R05-15, Trunkline (TL04) and new spoil disposal area (SP02)	Fish and macroinvertebrates, aquatic habitats assessment
2023	Waterways within R03, CPF P3 waterways, Purari River, upstream (AQ44) and downstream (AQ43) of Kuku Creek and the existing Herd Base site, Spoil disposal site R05-03 R05-04, R05-06, Camp 2, Camp 3	Fish and macroinvertebrates
2024	Waterways within R03, Purari River, upstream (AQ44) and downstream (AQ43) of Kuku Creek and the existing Herd Base site, CPF P3 waterways	Fish and macroinvertebrates
2025	Purari River	eDNA samples for aquatic species

See Figure 6-33 below for an example of aquatic baseline survey locations.

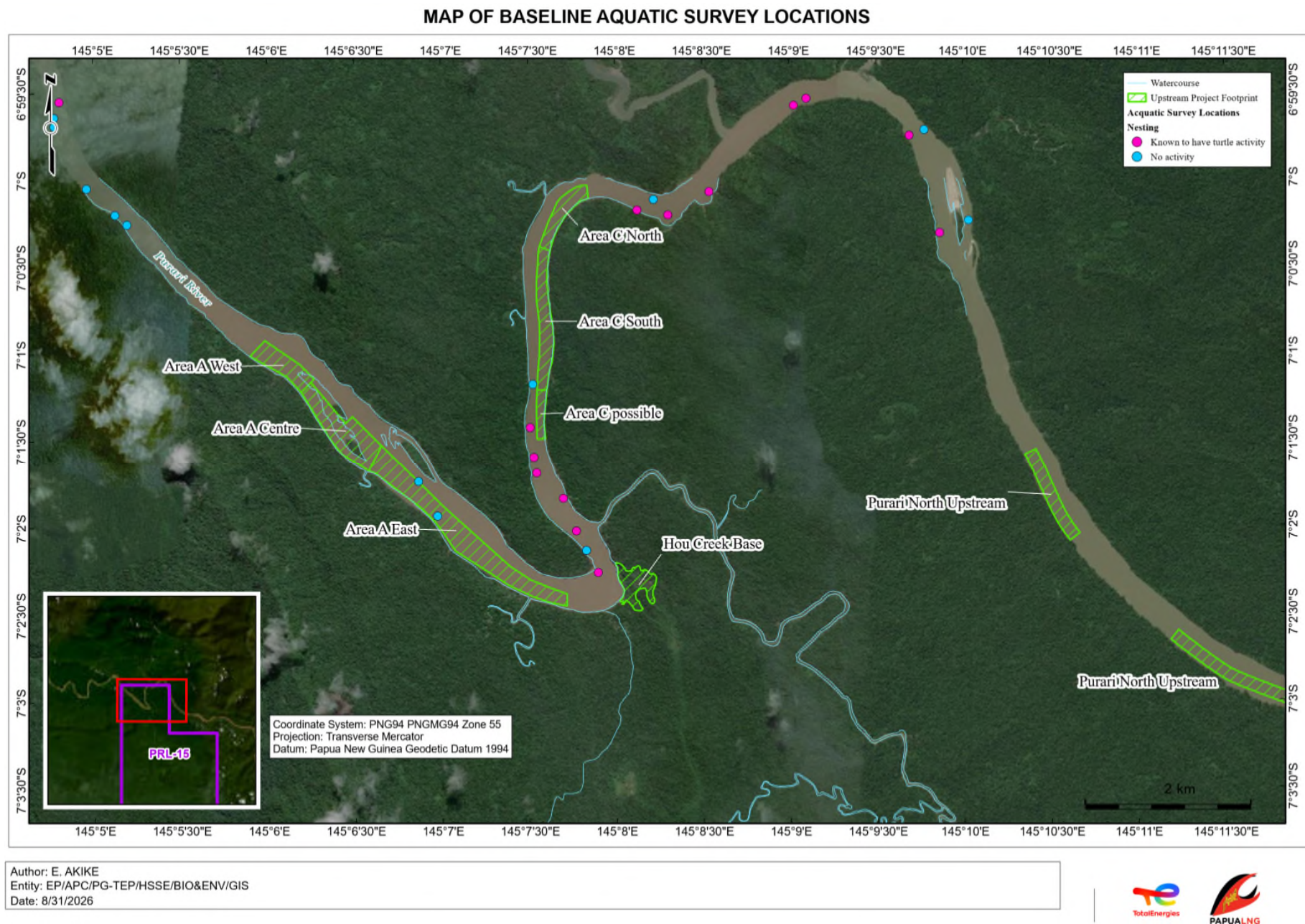


Figure 6-33: An example of aquatic survey locations around Hou Creek. (Source: Hou Creek Technical Note, 2026)

A Freshwater CHA (2025) has been conducted in line with IFC PS6, to identify freshwater biodiversity that qualifies as Critical Habitat. A range of biodiversity impact assessments have also been conducted that assess Project-impacts on freshwater biodiversity, that include the EIS (2019), EIS Addendum (2024), D&B ESIA (2025), Hou Creek Aggregate Dredging EAR (2025), and FEED Changes EAR (2025). The Project has committed to a range of management plans designed to mitigate identified impacts, and these are also summarised in this section.

Freshwater and Estuarine Habitats

The freshwater and estuarine habitats in the study area form a broad and interconnected system extending from the forested tributaries of PRL-15 to the expansive floodplain and mangrove-fringed delta of the Purari River. Together, these habitats comprise plateau catchments, low-gradient tributary streams, alluvial forests, oxbow lakes, freshwater swamps and deltaic plains, transitioning downstream into tidally influenced estuaries and mangrove forests. Within these habitats are a number of defined and undefined waterways. The undefined waterways comprise ephemeral drainage lines and shallow depressions that convey runoff during rainfall events, reflecting the dissected nature of the plateau landscape and its strong hydrological connectivity to the Purari River.

Within PRL-15, the plateau catchments are characterised by clear-water streams flowing through intact lowland forest. These tributaries range from confined, higher-gradient headwaters with rocky substrates to lower-gradient systems with gravel and sand beds, woody debris and well-developed riparian vegetation. They represent relatively undisturbed freshwater environments that provide habitat for diverse fish, macroinvertebrates and crustaceans.

Downstream, the Purari River broadens into a floodplain system. This landscape includes seasonally inundated delta swamps and plains, freshwater wetlands, flooded forests and oxbow lakes formed from abandoned meander bends. These habitats are dynamic and strongly influenced by seasonal flooding, which drives sediment deposition, nutrient exchange and connectivity between main channels and off-channel wetlands. Alluvial forests and swamp woodlands fringe these waterbodies, and submerged grasses and macrophytes occur along wetland margins. The floodplain environment provides important habitat for freshwater fish, turtles and macrocrustaceans, as well as breeding and nursery areas for species that move between riverine and floodplain habitats (e.g. freshwater and estuarine fish).

Further downstream, the system transitions into the mangrove forests and estuaries of the Purari River delta. Here, freshwater flows meet tidal influence from the Gulf of Papua, creating a mosaic of brackish channels, distributaries and mangrove-lined creeks. Mangrove communities, including species of *Sonneratia*, *Rhizophora*, *Avicennia*, *Bruguiera* and *Nypa*, dominate the lower delta and estuarine margins. These environments are highly productive and function as nursery habitat for estuarine and marine-associated fish and crustaceans, while also supporting species that utilise both freshwater and coastal waters. Upper estuarine creeks are often poorly flushed and organically rich, contrasting with the more open, tidally exchanged distributary channels closer to the coast.

Freshwater EAAAs

As part of developing the Freshwater CHA, EAAAs were defined by the distributions of candidate species or ecosystems assessed under Criterion 1 to 4 and determined according to 'the ecological patterns, processes, features and functions that are necessary for maintaining them' (IFC, 2019, GN59). The freshwater EAAAs span a total of 45,5603ha.

For the purpose of the Freshwater CHA, four EAAAs were described which represent the geographic extent covered by species groups such as fish, elasmobranchs, turtles, sharks and cetaceans:

- Delta Rim, where distributary channels and floodplain habitats interface
- Lower Purari River, defined by its wide, turbid and seasonally dynamic main channel
- Delta Swamps & Plains, comprising freshwater wetlands and alluvial forest mosaics
- Mangroves & Estuaries, where tidal processes shape brackish habitats and coastal vegetation communities.

These zones are not discrete ecological units but rather reflect gradients in hydrology, salinity, geomorphology and habitat structure. See Figure 6-35 for the Freshwater EAAAs.

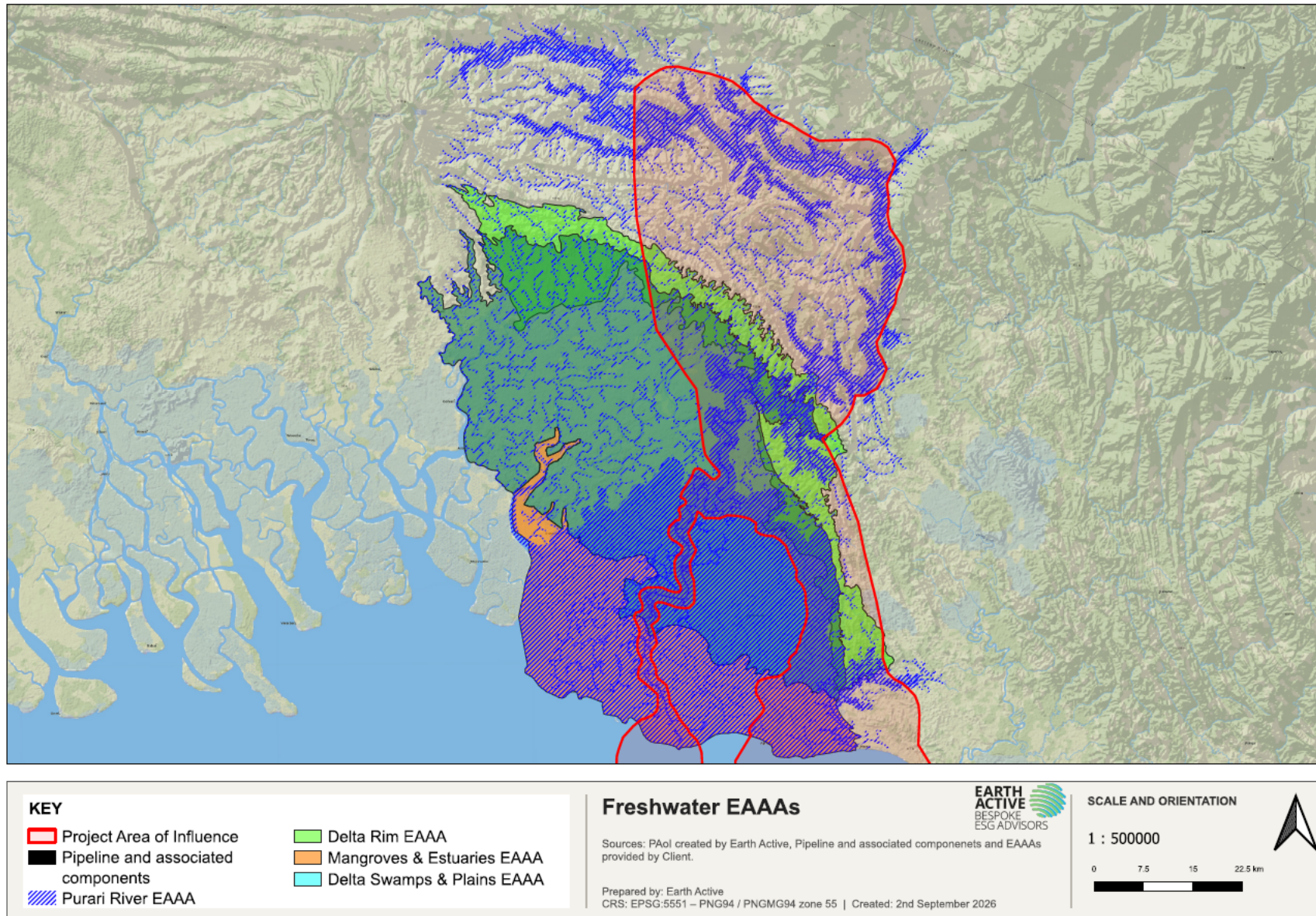


Figure 6-34: Freshwater EAAAs (Source: Earth Active, 2026)

Overall, freshwater and estuarine habitat provides strong hydrological connectivity, seasonal inundation dynamics and a transition from clear upland tributaries to turbid lowland rivers and productive mangrove estuaries. The result is a diverse freshwater and estuarine landscape that supports a wide range of aquatic habitats and associated flora and fauna. Table 6-58 below summarises the sensitivity of these habitats present in the PAoI based on an assessment of their vulnerability (likelihood of a biodiversity value being lost) and irreplaceability (the spatial limitation of a biodiversity value).

Table 6-58: Sensitivity rating of freshwater and estuarine habitats

Habitat type	Description of criteria	Sensitivity
B. hainesii stands	Area supports species with extreme vulnerability.	Very High
Estuarine wetlands	Area used by species with moderate, high and extreme vulnerability (<i>Pristis pristis</i> and <i>G. typus</i>) that is critical to life cycle functions (i.e., spawning and nursery areas for a range of fish species).	High
Oxbow lakes (including the PRL-15 oxbow wetlands) and off-river water bodies	Area potentially supports unique assemblages of aquatic species and is a unique landscape feature within the lower Purari River catchment. Note: As it is uncertain whether oxbows actually support unique assemblages, the sensitivity rating of this habitat is high rather than extreme.	High
Plateaus	Area potentially supports unique assemblages of species due to isolation or discontinuity. Note: As it is uncertain whether plateaus actually support unique assemblages, the sensitivity rating of this habitat is high rather than extreme.	High
Crater Mountain Wildlife Management Area	Protected area.	High
Unconfined turbid major river systems (including the Purari, Urika-Ivo and Wame-Varoi rivers)	Area potentially used by species with extreme vulnerability (<i>Pristis</i> and <i>Glyphis</i> spp.) for activities other than those critical to the life cycle of the species. Note: As the species occurrence in this habitat is currently unconfirmed, the sensitivity rating is moderate rather than high.	Medium
Freshwater floodplain wetlands on deltaic plains	Area potentially used by species with moderate, high or extreme sensitivity (<i>Pristis pristis</i> , <i>Glyphis</i> spp. and <i>Glaucostegus typus</i>) for activities other than those critical to the life cycle of the species. Note: As the use of this habitat by these species is currently unconfirmed, the sensitivity rating is moderate rather than high or extreme.	Medium
Mouth or delta of large river systems	These areas represent a potential congregation point for various aquatic species that are able to move between marine and freshwater systems, including as part of lifecycle migrations. They have been given a moderate sensitivity rating because there are no distinctive migration routes of any species within the study area.	Medium
Low-gradient slow- to moderate-flowing rivers and backwaters of large rivers	Habitat type does not support specific life cycle functions of species with moderate, high or extreme vulnerability and is not considered to be unique.	Low

Sensitive species

A total of 12 species were identified in the Freshwater CHA (2025) as having met or exceeded thresholds for IFC Criteria 1(a) (Habitat required to sustain ≥ 0.5 percent of the global population of a CR or EN species/subspecies) and (b) (Habitat with known, regular occurrences of CR or EN species where that habitat

is one of 10 or fewer discrete management sites globally for that species). One species met Criterion 2 (Areas that regularly hold more than 10% of the global population size and more than 10 reproductive units of a species), and two species met 3(a) (Habitat known to sustain, on a cyclical or otherwise regular basis, $\geq$ one percent of the global population of a migratory or congregatory species).



Figure 6-35: *Anoxypristis cuspidata* – narrow sawfish IUCN (EN) (Source: Impacts Terrestrial, 2019)

Invasive Species

Invasive freshwater vertebrate fauna species have been recorded in the Purari River and its confluent tributaries. This includes the common carp (*Cyprinus carpio*), tilapia (*Oreochromis mossambica*), mahseer besta (*Tor sp.*), golden mahseer (*Tor putitora*) and trout (family *Salmonidae*). All have been recorded in fish catches either by direct observation or anecdotal evidence provided during the 2025 fisheries baseline study (report in preparation). In addition, a 2025 eDNA study confirmed the presence of three invasive fish species in the Purari River, Nile tilapia (*Oreochromis niloticus*), common carp and walking catfish (*Clarias batrachus*) D&B ESIA, 2025). Small-bodied Poeciliidae invasive species such as the mosquitofish (*Gambusia affinis*) and guppy (*Poecilia reticulata*) are not known in the Purari River but could occur, especially in slower flowing streams of PRL-15 and floodplain environments of the export pipeline. One aquatic weed species water hyacinth (*Eichhornia crassipes*) is likely to occur in the tributaries of PRL-15 and close to KP9 and may inhabit the floodplains of the export pipeline. This species inhabits still or slow-moving waterbodies.

Contaminants

Freshwater fish species were tested for contaminants in 2017 and results showed that several metals had concentrations greater than Guideline Exposure Levels (GELs) or Maximum Levels (MLs) particularly for copper, lead, zinc and arsenic levels in several of the sampling locations along the Purari River.

6.17.3 Impact Assessment

Despite efforts made to avoid sensitive areas during design and routing options, potential impacts still remain on sensitive receptors. The following impacts to freshwater biodiversity due to Project activities have been identified in the EIS (2019), FEED Changes EAR (2025), Hou Creek Aggregate Dredging EAR (2025) and D&B ESIA (2025) as:

- Direct disturbance and habitat fragmentation.
- Increased suspended sediment and sedimentation levels due to increases in suspended sediment levels and in-stream sedimentation from earthworks and spoil stockpiling will occur in waterways located directly adjacent to construction sites subject to ground disturbance.
- Fauna strike and entrainment.
- Introduction and spread of aquatic pests.

- Physiological injury or behavioural disturbance to aquatic fauna due to underwater noise (see section 6.6.8).
- Impacts on the quality of waterways due to dredging and in-river disposal of dredge material during the construction phase.
- Impacts on the quality of the water ways and hence freshwater species and habitats due to planned discharge of wastewater (hydrotest water, sewage effluent) or contaminated stormwater.

6.17.4 Mitigation

Mitigation measures for Project impacts to freshwater species and habitats are detailed in Table 6-59. The following Management Procedures have been developed to mitigate impacts on freshwater biodiversity features:

- Project Ecology Management Procedure.
- Large Freshwater Turtles Management Procedure.
- Project Invasive Species, Pathogens and Pests Management Procedure.
- Project Dredging Management Procedure.
- Project Noise and Vibration Management Procedure.
- Project Traffic and Transport Management Procedure.
- Project Spills and Accidental Release Management Procedure.

Table 6-59: Mitigation measures -Freshwater and estuarine biodiversity

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
Deterioration in waterway surface water quality due to discharges and contamination	EM008	Minimisation	Sewage effluents from Project facilities will be treated to meet the environment (waste discharge) permit before discharge, in accordance with applicable standards.	<i>EIS/ Upstream CESMP; 2019</i>
	EM015	Minimisation	Hydrotest water management will consider: • The definition of volume and discharge rates and discharge locations. • Chemicals additives selection, according to requirements defined in embedded design controls. • Reusing hydrotest water to minimise the discharge volume. • Reducing the need for chemicals by minimising the time hydrotest water remains in the pipeline. • Monitoring hydrotest water discharges to the environment against applicable limits.	<i>EIS/ Upstream CESMP; 2019</i>
	EM016	Minimisation	Training and test releases of firefighting foams at the CPF are to be contained within appropriate drainage water treatment networks.	<i>EIS/ Upstream CESMP; 2019</i>
Deterioration in water surface water quality due to accidental hydrocarbon or chemical releases	EM017	Minimisation	Vehicle wash down and fuel handling will be undertaken considering possible receptors e.g., streams, Purari River and the marine environment	<i>EIS/ Upstream CESMP; 2019</i>
	EM018	Minimisation	An Emergency Response Plan will be developed to effectively manage the preparedness and response to emergency events. It will contain: • Site Contingency Plans, that will consider fire management measures. • An Oil Spill Contingency Plan, that will consider spill risks for construction, operation and decommissioning of facilities and associated infrastructure, and supply services on land and in aquatic and marine environments. • A Blow Out Contingency Plan including well blowout control and contingency measures.	<i>EIS/ Upstream CESMP; 2019</i>
	EM019	Minimisation	Vessels will be required to have shipboard Oil Pollution Emergency Plans/Oil Spill Contingency Plans as per TotalEnergies' requirements and Marine Pollution (Ships and Installations) Act 2013.	<i>EIS/ Upstream CESMP; 2019</i>
Direct loss of aquatic habitat within CPF footprint and at stream crossings	EM001	Avoidance / Minimisation	All sites proposed for development as part of the Project will be subject to a preconstruction survey to clearly identify acid sulphate soils, sensitive sites and habitats, e.g. roosting, breeding, nesting and threatened species sites, priority ecosystem services, archaeological sites, burial sites, sites of religious importance to be subject to specific mitigation measures.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
	EM020	Minimisation	Maintain hydraulic and biological connectivity during construction and operations in natural flow lines across linear infrastructure, such as pipelines and roads, and in relation to water extraction, e.g. dams, including: • Install appropriately sized culverts, drains and structures to allow fish passage, according to good international industry practice standards. • Rehabilitate waterways after construction and decommissioning to a sustainable, stable state, that reflects the original character, and maintains waterway flows and connectivity.	<i>EIS/ Upstream CESMP;</i> 2019
	EM024	Minimisation / restoration	Maintain a minimum practical distance from sensitive features to minimise potential degradation and disturbance. Buffer distances shall be ecologically relevant, considering: • Sensitive habitats, i.e. primary alluvial forest, mangroves, riparian vegetation along forest streams. • Habitats that provide focal breeding, roosting or feeding sites for sensitive fauna, e.g. caves, rock shelters, rock outcrops, large trees with hollows, large trees with nests, bird-of-paradise display trees, forest pools, large fig trees (<i>Ficus</i> spp.) and vines of the family <i>Aristolochiaceae</i>. • Sites that support populations of IUCN Threatened or rare and localised plant species.	<i>EIS/ Upstream CESMP;</i> 2019
Smothering of fauna and habitat	EM002	Minimisation	Progressively clear vegetation and rehabilitate cleared areas as soon as practicable to minimise the time cleared areas are exposed; and allow fauna to move away from areas to be cleared, where practicable.	<i>EIS/ Upstream CESMP;</i> 2019
	EM003	Minimisation	Cut trees where practicable to retain the rootstock and maintain soil stability.	<i>EIS/ Upstream CESMP;</i> 2019
	EM004	Minimisation	Erosion and sediment control measures will be implemented for infrastructure components in accordance with good international industry practice to effectively manage stream and river flows, stormwater, surface erosion, sedimentation and scour, e.g. drainage diversion into surrounding vegetation, rip-rap aprons, rock armoring, energy dissipators, sediment control ponds, mulch berms and sediment fences, where required, until the area has been effectively stabilised and/or rehabilitated.	<i>EIS/ Upstream CESMP;</i> 2019
	EM005	Minimisation	Stabilise spoil stockpiles and areas of ground disturbance as soon as practicable after initial disturbance using, e.g., mulched vegetation, aggregates and soil binders.	<i>EIS/ Upstream CESMP;</i> 2019

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
	EM006	Minimisation	Areas of higher risk of landslides e.g., steep gradients, previously disturbed land, likely to occur from the works, or likely to be exacerbated by the works, will be stabilised to reduce the landslide risk.	<i>EIS/ Upstream CESMP; 2019</i>
	EM010	Minimisation / Avoidance	Minimise or avoid sidecasting during construction (e.g. for road, pipeline, wellpad and CPF works). Any sidecasting that does occur will avoid defined stream channels.	<i>EIS/ Upstream CESMP; 2019</i>
	EM012	Minimisation	Maintain hydraulic and biological connectivity during construction and operations in natural flow lines across linear infrastructure, such as pipelines and roads, and in relation to water extraction, e.g. dams, including: - Install appropriately sized culverts, drains and structures to allow fish passage, according to good international industry practice standards. - Rehabilitate waterways after construction and decommissioning to a sustainable, stable state, that reflects the original character, and maintains waterway flows and connectivity.	<i>EIS/ Upstream CESMP; 2019</i>
	EM013	Minimisation	Minimise in-stream and stream bank disturbance during high rainfall.	<i>EIS/ Upstream CESMP; 2019</i>
	EM037	Minimisation	Where required, implement adaptive management to minimise dredging impacts on sensitive habitats and species.	<i>EIS/ Upstream CESMP; 2019</i>
Habitat loss	EM001	Avoidance / Minimisation	See Above	<i>EIS/ Upstream CESMP; 2019</i>
Contamination and degradation of wetland habitat	EM011	Minimisation	Water from trenches will be discharged in accordance with applicable water quality standards with erosion and sediment controls where relevant.	<i>EIS/ Upstream CESMP; 2019</i>
	EM012	Minimisation	See Above	<i>EIS/ Upstream CESMP; 2019</i>
	EM030	Minimisation	Dispose of excess spoil material from Project earthworks in designated spoil disposal sites	<i>EIS/ Upstream CESMP; 2019</i>
Loss of individuals or population of forest flora and fauna from project activities and hunting by project workers	EM001	Avoidance / Minimisation	See Above	<i>EIS/ Upstream CESMP; 2019</i>
	EM002	Minimisation	See Above	<i>EIS/ Upstream CESMP; 2019</i>
	EM027	Avoidance	Project personnel, workers, contractors or third-party operators, while engaged in Project activities, will be prohibited: To light and use fire except for specific work requirements controlled under the 'Hot Works' permit procedure and in designated smoking areas.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
			- To hunt, fish, collect or disturb forest or wildlife resources. - To possess hunting or fishing equipment, including firearms, bow and arrows, spears, rubber guns, slingshots and other hunting tools. - To keep pets or to purchase, acquire or possess any wildlife or wildlife products.	
	EM028	Minimisation	All Project personnel, workers, contractors and 3rd party operators will be educated during inductions and safety training about: - Fire risks, including the heightened risk during extreme drought years and smoking. - Wildlife values. - Weed, pathogen and animal pest hygiene and control measures. - Identification of cultural heritage, cultural heritage awareness, measures for avoiding impacts and the Chance Finds Procedure.	<i>EIS/ Upstream CESMP; 2019</i>
	EM031	Minimisation	Use a suitably trained fauna handler to relocate fauna, where practicable, before vegetation clearing.	<i>EIS/ Upstream CESMP; 2019</i>
	EM032	Minimisation	When a significant impact remains on IUCN Threatened species or rare and localised plant species, translocation and propagation shall be considered when ecologically feasible.	<i>EIS/ Upstream CESMP; 2019</i>
	EM033	Minimisation	Develop Traffic and Transport Management controls that include: - Posting speed limits on Project roads via posted speed limit signs. - Requiring vehicles to keep to posted speed limits. - Keeping vehicles and mobile machinery to marked trafficable areas and work sites.	<i>EIS/ Upstream CESMP; 2019</i>
	EM041	Minimisation	Implement dust control, where required.	<i>EIS/ Upstream CESMP; 2019</i>
	EM001	Avoidance / Minimisation	See Above	<i>EIS/ Upstream CESMP; 2019</i>
Reduction in the population of IUCN threatened freshwater turtles	EM022	Minimisation	Implement lower speeds past aquatic fauna when observed in the water.	<i>EIS/ Upstream CESMP; 2019</i>
	EM024	Minimisation/ Restoration	See Above	<i>EIS/ Upstream CESMP; 2019</i>
	EM049	Minimisation	Develop and implement a comprehensive IUCN Threatened Freshwater Turtle Species Management Program, that will: Engage with Piku Biodiversity Network (PNG non-government organisation (NGO)) and/or other ecologists as required.	<i>EIS Addendum; 2024</i>

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
			- Educate/train and engage local resident landowners in an effort to curb currently unsustainable hunting levels. - Initiate studies into the location and timing of nesting and to document harvesting rates. - Monitor local populations.	
	EM050	Minimisation	Targeted baseline studies will be undertaken to better understand the ecology and population status of the study area's IUCN threatened freshwater turtles and the harvesting practices of local residents. These studies will be undertaken prior to construction and will be followed by long-term monitoring of breeding and harvesting activity. The results of these studies may lead to amendment of or addition to existing mitigation measures.	<i>EIS Addendum; 2024</i>
Disturbance to or loss of IUCN Threatened freshwater turtle river bank and crocodile nest sites and nest failure	EM024	Minimisation/ Restoration	See Above	<i>EIS/ Upstream CESMP; 2019</i>
	EM033	Minimisation	See Above	<i>EIS/ Upstream CESMP; 2019</i>
	EM014	Minimisation	Implement low speed limits through areas sensitive to vessel wash.	<i>EIS/ Upstream CESMP; 2019</i>
	EM049	Minimisation	See Above	<i>EIS Addendum; 2024</i>
	EM050	Minimisation	See Above	<i>EIS Addendum; 2024</i>
Loss of individual migratory shorebirds, resident marine coastal birds and freshwater wetland birds and disturbance to feeding or roosting congregations and breeding sites	EM019	Minimisation	See Above	<i>EIS/ Upstream CESMP; 2019</i>
Invasive species, weeds, and pathogens	EM023	Minimisation	Management controls will be developed for weed, pathogen and pest that pose a significant threat to biodiversity, including: Specific risk-based control methods, and procedures targeting Priority 1 and 2 weeds and pest fauna.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
			- A quarantine management program for moving people, equipment and supplies in accordance with PNG law. - Tools for field personnel to identify Priority 1 and 2 weeds and pest fauna.	
	EM028	Avoidance / Minimisation	See Above	<i>EIS/ Upstream CESMP; 2019</i>

6.17.5 Residual Impacts

Table 6-58 below provides a summary of the latest assessment of the Project's residual impacts on freshwater biodiversity values. After applying the mitigation measures, the majority of residual impacts on freshwater and estuarine biodiversity have been reduced to Minor to Negligible significance with the exception of four cases which are Moderate (direct loss of habitats at the CPF location, smothering of fauna and habitat in tributary streams from sediment generated by ground disturbance at the CPF P3 site and the PRL-15 site, and toxicity effects on aquatic fauna due to accidental hydrocarbon or chemical spills at dredging sites on the Purari River (Hou Creek) close to CMWMA. The RIA conducted by Earth Active Ltd, which used a wider range of biodiversity metrics to quantify losses in line with IFC PS6, identified residual impacts to freshwater and estuarine habitat resulting from habitat disturbance and fragmentation, as well as increased suspended sediment and sedimentation levels in tributary streams within the CPF footprint, due to proposed earthworks and physical infrastructure. These impacts are predicted to result in the direct loss of approximately 0.66 Qha of riverine habitats.

These riverine habitats are associated with a range of Critical Habitat-qualifying freshwater species: Boeseman's Rainbowfish, Lake Kutubu Rainbowfish, Hurtle's Whipray, and *Neosilurus brevidorsalis*. However, there is no confirmed presence of these species within the CPF footprint via Project surveys to date. The NGFS has identified a set of net gain targets, in line with IFC PS6 requirements, selected to compensate for the Project's residual losses to freshwater Critical Habitat-qualifying features.

Table 6-60: Summary of potential residual impacts - Freshwater and estuarine biodiversity (Source(s): EIS Impacts Terrestrial (2019); FEED Changes EAR (2025))

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
Habitat disturbance and fragmentation	Earthworks and physical infrastructure	Direct loss of aquatic habitat within CPF footprint	CPF P3 site	C	EM001 EM024	Medium / Medium	Moderate
		Direct loss or disturbance of aquatic habitat due to earthworks	Borrow pits and access tracks	C	EM001 EM024	Low / Minimal	Negligible
	Construction works and onshore pipeline construction – pipeline and road crossings of waterways.	Direct loss of aquatic habitat at stream crossings and blockage of fish passage leading to population declines.	PRL-15 Export pipeline route	C	EM001 EM004 EM020 EM024	Medium / Low	Minor
	Construction of water supply dams on Hou and Boa creeks	Direct loss of aquatic habitat in the footprints of extraction infrastructure in Hou and Boa creeks.	PRL-15	C	EM001 EM020	Medium / Low	Minor
		Modification of aquatic habitat and fish movement in Hou and Boa creeks.	PRL-15	C	EM021 EM024	Medium / Low	Minor
	Dredging (Purari River)	Direct loss or disturbance of aquatic habitat due to dredging on the Purari River – turtle nesting beaches	Purari River	O	EM024 EM033 EM014 EM049 EM050	Medium / Minimal	Negligible
						High / Minimal (CMWMA)	Minor
		Direct loss or disturbance of aquatic habitat due to dredging on the Purari River – stream bed	Purari River	C, O	EM001 EM024	Medium / Low	Minor
						High / Minimal (CMWMA)	Minor
Increased suspended sediment and	Earthworks and spoil disposal	Smothering of fauna and habitat in tributary streams from sediment generated by ground disturbance	CPF P3 site	C	EM002 EM003	Medium / Medium	Moderate
			CPF P3 site	C, D	EM004	Medium / Low	Minor

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
sedimentation levels		Smothering of fauna and habitat from sediment generated by construction phase ground disturbance and changes in surface cover – Mena River, Kuku Creek and Boa Creek.	PRL-15	C	EM005 EM006 EM010 EM012 EM013	Medium / Medium	Moderate
		Smothering of fauna and habitat from sediment generated by construction phase ground disturbance and changes in surface cover – Era River and Hou Creek.	PRL -15	C		Medium / Minimal	Negligible
		Smothering of fauna and habitat from sediment generated by construction phase ground disturbance and changes in surface cover – Purari River.	PRL -15 Export Pipeline route	C		Medium / Low	Minor
		Smothering of fauna and habitat from sediment generated by construction phase ground disturbance and changes in surface cover – waterways along export pipeline route.	Export Pipeline route	C		Low / Low	Minor
		Smothering of fauna and habitat from sediment generated from roads during operations phase – Boa Creek, Mena River, Kuku Creek and Oyomo Creek.	PRL -15	O		Medium / Low	Minor
		Smothering of fauna and habitat from sediment generated from roads during operations phase – Hou Creek and Era River.	PRL -15	O		Medium / Minimal	Negligible
		Smothering of fauna and habitat from sediment generated from roads during operations phase – Purari River.	Export pipeline route	O		Medium / Low	Minor
		Smothering of fauna and habitat from sediment generated from roads during operations phase – waterways along export pipeline route.	Export pipeline route	O		Low / Low	Minor

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
	Earthworks (Borrow pits and access tracks)	Adverse impacts on aquatic fauna due to increased levels of TSS, turbidity and sedimentation in waterways due to earthworks	Borrow pits and access tracks	C	EM002 EM003 EM004 EM005 EM006 EM010 EM012 EM013	Low / Minimal Medium / Minimal	Negligible
	Dredging (Purari River)	Adverse impacts on aquatic fauna due to increased levels of TSS, turbidity and sedimentation from dredging of the Purari River	Purari River	C, O	EM002 EM003 EM004 EM005 EM006 EM010 EM012 EM013	Medium / Minimal	Negligible
						High / Minimal (CMWMA)	Minor
Contamination of waterways	Planned wastewater discharges	Impacts on aquatic ecosystems and biota from discharge of treated sewage effluent – Purari River	CPF P3 site ; PRL 15	C, O, D	EM008 EM016	Medium / Minimal	Negligible
		Impacts on aquatic ecosystems and biota from discharge of contaminated stormwater and produced water – Purari River	CPF P3 site ; PRL- 15	O		Medium / Low	Minor
		Impacts on aquatic ecosystems and biota from firefighting foams discharges during fire response training and equipment testing – Purari River	CPF P3 site ; PRL- 15	O		Medium / Low	Minor
		Impacts on aquatic ecosystems and biota from discharge of hydrotest water – Purari River	PRL – 15	C	EM008 EM015 EM016	Medium / Low	Minor

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
	Accidental hydrocarbon or chemical releases; use of hazardous materials	Impacts on aquatic ecosystems and biota from hydrocarbon or chemical spill or leaks – Purari River and other PAOl waterways	PRL-15; Export pipeline route; River transport corridor	C, O	EM017 EM018 EM019	Medium / Low	Minor
		Impacts on aquatic ecosystems and biota from hydrocarbon or chemical spill or leaks – waterways adjacent CPF	CPF P3 site	C, O, D		Medium / Low	Minor
		Toxicity effects on aquatic fauna due to accidental hydrocarbon or chemical spills at dredging sites on the Purari River; and at borrow pits/access tracks	River transport corridor; borrow pits/ access tracks	C, O, D	EM017 EM018 EM019	Medium/Low	Minor
						High / Low (CMWMA)	Moderate
Introduction and spread of aquatic pest species.	Logistics and transport; vegetation clearing.	Introduction of new pest species to the PAOl reducing habitat quality and outcompeting and preying on native aquatic biota	PRL-15; River transport corridor	C, O	EM023 EM028	Medium / Minimal	Negligible
			Export pipeline route	C, O		Low / Minimal	Negligible
		Spread of existing aquatic weeds reducing habitat quality for native aquatic biota	PRL-15; River transport corridor	C, O		Medium / Low	Minor
			Export pipeline route	C, O		Low / Low	Minor
		Spread of existing invasive fauna outcompeting and preying on native aquatic biota	PRL-15; River transport corridor	C, O		Medium / Low	Minor
			Export pipeline route	C, O		Low / Low	Minor
	Borrow pits and access tracks; Dredging	Introduction of invasive species, diseases and pathogens from construction vehicles/machinery and dredging vessels	Borrow pits and access tracks; Purari River	C, O, D	EM041 EM037 EM050	Medium / Minimal	Negligible
				C, O, D		High / Minimal (CMWMA)	Minor

Key Sensitivity	Main Activity	Potential Impact	Location of Activity	Project Phase	Mitigation and Management	Residual Assessment	
						Sensitivity/ Magnitude	Significance
		Spread of invasive species, diseases and pathogens from construction vehicles/machinery and dredging vessels	Borrow pits and access tracks Dredging	C, O	EM023 EM050	Medium / Minor	Minor
Fauna strike	Logistics and transport (barging along waterways).	Vessel strike causing fauna injury or death.	River transport corridor	C,O	EM022	Medium / Minimal	Minor
Underwater noise	Dredging	Physiological injury or behavioural disturbance to freshwater fauna due to underwater noise from dredging activities		C, O	EM022 EM039 EM040	High / Minimal (fish with swim bladders)	Minor
						Medium / Minimal (fish without swim bladders)	Negligible
						Minimal/ Minimal (freshwater and estuarine crocodiles and turtles)	Negligible
	Pile driving			C	High / Minimal (fish with swim bladders)	Minor	
					Medium / Minimal (fish without swim bladders)	Negligible	
					Minimal/ Minimal (crocodiles)	Negligible	
					Minimal/ Minimal (turtles)	Negligible	
	Vessel traffic			C, O, D	Low /Minimal (fish in general, crocodiles and turtles)	Negligible	

C = Construction, O = Operations, D = Decommissioning and closure

6.18 Biodiversity – Marine

6.18.1 Introduction

This section presents a synthesis of Project documentation relating to marine biodiversity. This includes a summary of the activities undertaken to assess biodiversity impacts on marine habitats, fauna and flora in accordance with IFC PS6. It builds on baseline survey results outlined in the EIS (2019) and a range of marine surveys conducted since original marine baseline surveys in 2016. The Project has identified marine biodiversity that qualifies as Critical Habitat, in line with IFC PS6, after completing a Marine CHA (2025). Impacts and appropriate mitigation measures to marine biodiversity have been described in FEED Changes EAR (2025), EIS (2019), and these are all summarised in this section.

6.18.2 Baseline

Field surveys for marine biodiversity were undertaken in 2016 and 2017 and then again in 2023 and 2024 to bridge gaps and survey locations based on the latest Project footprint options. Surveys included mapping benthic habitats, including sensitive receptors such as coral reefs, rocky reefs and seagrasses, sampling benthic macroinvertebrates in different substrate types, surveying reef fish assemblages in Caution Bay by baited remote underwater video systems (BRUVS) and assessing the occurrence of threatened or protected marine species or potential sensitive habitat in the study area by diving. See Figure 6-36 for the locations of the marine surveys.

Table 6-61: List of marine surveys undertaken

Survey Date	Survey Location	Ecological receptors surveyed
2016	Orokolo Bay - offshore of the Purari and Vailala river deltas, offshore export pipeline route	Benthic biotope and epibenthos, marine flora and fauna
2017	Caution Bay, south of existing PNG LNG gas pipeline, offshore export pipeline corridor, Orokolo Bay	Benthic biotope and epibenthos, live coral and seagrass, benthic macroinvertebrates, marine fauna and flora
2023	Caution Bay, Offshore (Corridor area), Orokolo Bay, water stations across the marine PAOI: Orokolo Bay, offshore pipeline corridor and Yule Island, Caution Bay, Along vessel tracklines within the PAOI and in transit to/from Port Moresby	Marine megafauna: marine mammals, sea turtles, seabirds, fish and sea snakes, Water physico-chemistry: CTD/multiparameter profiles, nutrients, TOC, suspended solids, trace metal elements, hydrocarbons (incl. PAH), microbiology, chlorophyll and phaeopigments, Phytoplankton and zooplankton sampling; (FlowCAM and ZooScan analysis), Sediment physico-chemistry: grain size, organic and nutrient enrichment, trace metal elements, hydrocarbons, microbiology, microbenthic fauna, seabed habitats, epibenthic fauna, Marine - seabed, including soft sediment, rocky outcrops, rubble reef and seamount reef (8-71 m water depth)
2024	Caution Bay: shoreline reef, offshore reef along the islands and seamount reefs, inshore reef	Hard and soft corals and associated reef biota, including bleaching, disease and predation

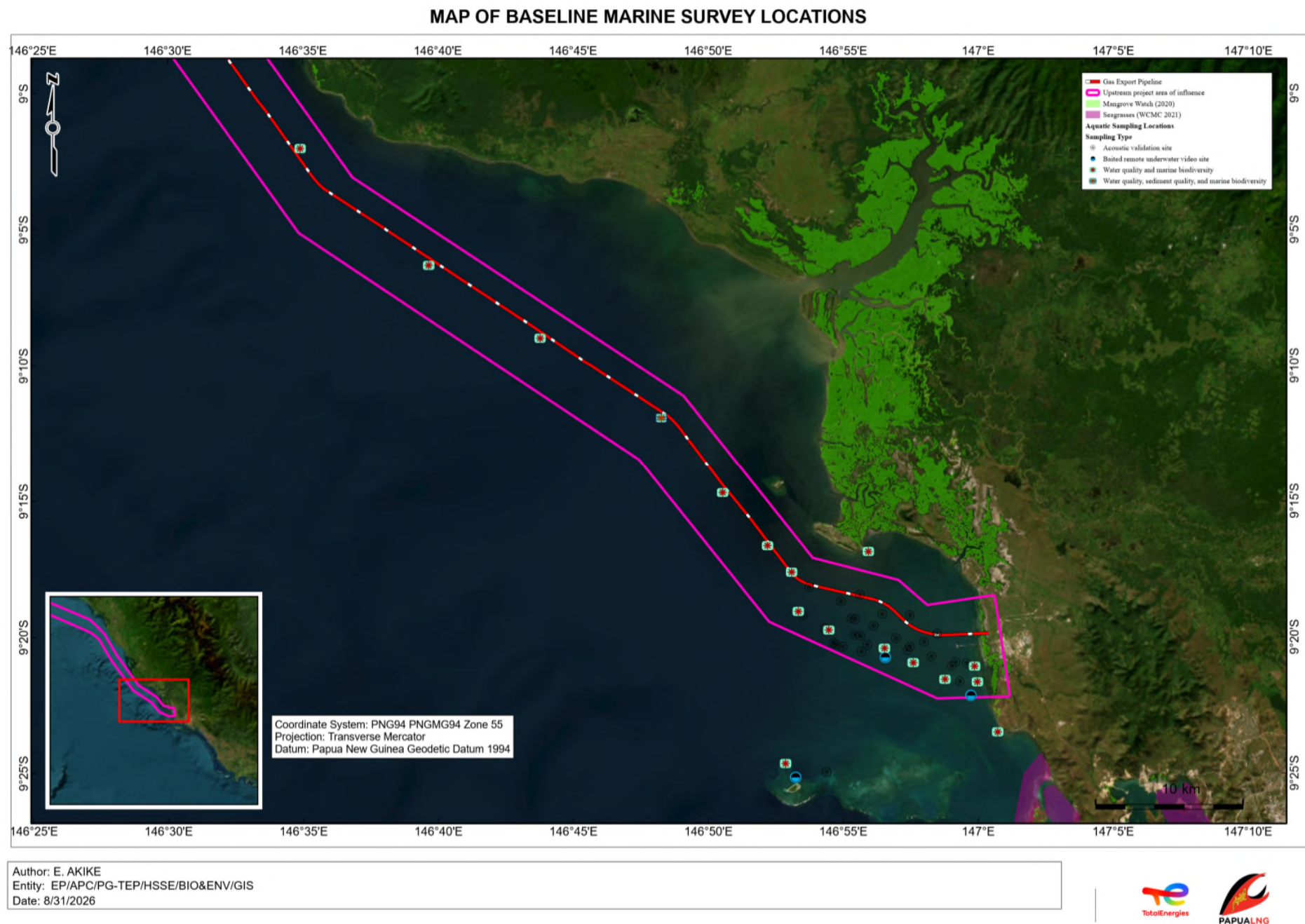


Figure 6-36: Map of baseline marine survey locations (Source: TEP PNG, 2026)

Marine EAAAs

As part of developing the CHA, EAAAs were defined by the distributions of candidate species or ecosystems assessed under Criterion 1 to 4 and determined according to 'the ecological patterns, processes, features and functions that are necessary for maintaining them' (IFC, 2019, GN59).

For the purposes of this Marine CHA (2025) six EAAAs were identified within the seascape, and can be described as follows:

- 0 - 50 m depth
- 0 - 100 m depth
- 0 - 200 m depth
- Mangrove and estuarine habitat
- Coral reef habitat
- Seagrass habitat.

See below Figure 6-37 for marine EAAAs.

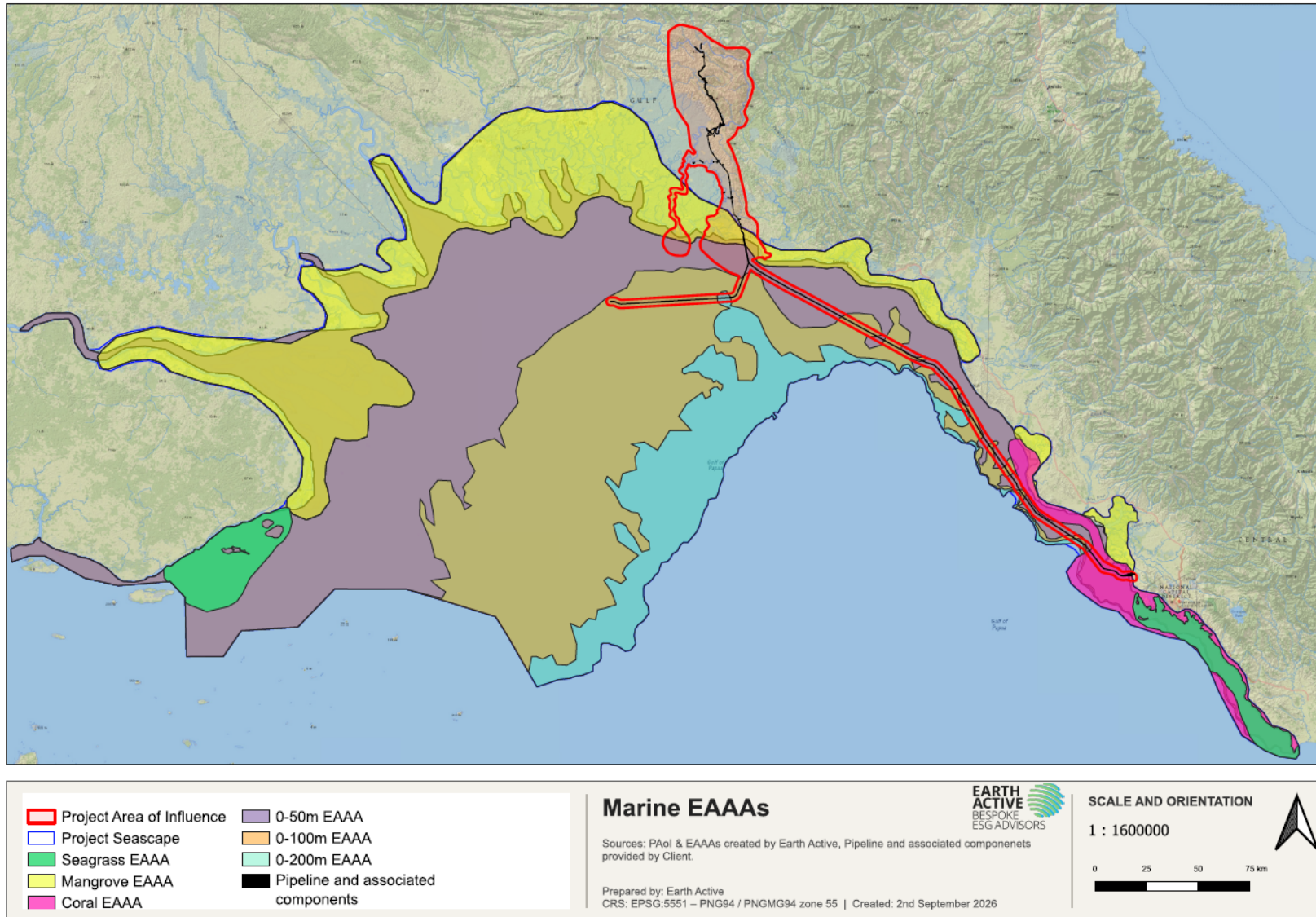


Figure 6-37: Marine EAAAs (Source: Earth Active, 2026)

Habitat Types

Four major marine benthic habitat types were identified in the study area, including beach and intertidal flats, seagrass meadows, subtidal coral and rocky reefs, and soft sediments.

Mangrove communities, which dominate the coastline throughout the Purari River delta and the eastern coast of Caution Bay, are considered as part of estuarine communities. Riverine and marine deposition has produced tidal flats and created conditions adequate for mangrove forests to populate the coast, through and adjacent to which the pipeline route will pass. The floristic characteristics of the mangrove communities are further described in the EIS Vol. 2 Part 05 Upstream Freshwater & Estuarine Biodiversity Baseline (2017).

Offshore, the PAol passes through the Coral Triangle. Only two coral reefs directly overlap with the PAol: Yule Island Reef (approximately 160km northwest of Port Moresby) and Idihi Island Reef on the southern edge of Caution Bay. Features of particular interest include an area of coral (*Pavona clavus*) suggested to be more than 150 years old (Caution Bay Habitat Assessment, Tetra Tech Coffey (2023)). The health of the reefs is a cause for concern due to the high coral mortality observed recently throughout the area, probably due to the bleaching episodes of recent years.

The Eastern Gulf is characterised by a narrow continental shelf where patches of sea grass can also be found. Along most of the eastern coastline of Caution Bay seagrass meadows are located between the mangroves and deeper sandy seabed areas. No seagrasses have previously been observed east of the fringing reef habitat, and it was suggested that this was likely because of the deeper waters. The main seagrass species that were recorded in Caution Bay included *Enhalus acroides*, *Syringodium isoetifolium* and *Cymodocea spp*, none of which are protected. There were also sparse beds (i.e. less than 5% coverage) of *Halophila* species located in the northern area of Caution Bay.

Seagrass meadows in Caution Bay are considered to have a high ecological significance, as they stabilise the substrate and provide nursery and feeding habitats for a range of marine organisms, including prawns, lobsters, fish, and turtles. No seagrass meadows have previously been found in the offshore waters along the offshore export pipeline corridor. As seagrasses rely on light to support photosynthesis, it is unlikely that the deeper waters would support seagrasses. Previous research has identified that seagrasses are generally confined to water depths of below 20 m, although some *Halophila* and *Zostera* species have been reported at depths beyond 50 m. See Figure 6-38 and Figure 6-39 below for examples of marine habitats.



Figure 6-38: Approach to Purari River Delta (Source: EIS Impacts Marine, 2019)



Figure 6-39: Orokolo Bat Coastline (Source: EIS Impacts Marine, 2019)

Table 6-62 below presents the marine habitat assessment and sensitivity based on surveys conducted.

Table 6-62: Marine habitat assessment and sensitivity based on surveys conducted for the Marine EBS (2024)

Habitat type	Data acquisition	Habitat description	Sensitivity
Dense fringing coral reef	Dive	Sandy areas and reef patches with high living corals density.	High
Exposed reef crest	Satellite imagery	Probably high coral diversity and density on a complex reef substrate.	High
Mangrove	Satellite imagery/ literature	Mangrove forest with a high density, species diversity, and tree abundance. Probably dominated by the red species <i>Rhizophora stylosa</i> .	High
Seamount slope with scattered corals	Dive	Bioconstructed substrate made of dead rubble or sparse elevated reef patches mixed with mud. High coral diversity with variable coral cover ranging from low to medium. Frequent coral bleaching all along the slope.	High
Top of the seamount dominated by dead corals	Dive	Bioconstructed reef rock with occasional sand patches. High rate of coral mortality, including large colonies such as <i>Acropora</i> sp. tables. High coral diversity but with generally low density and only small-size colonies. Coral cover is variable and can be high in some part of the top of seamounts.	High
Seagrass or macroalgae	Satellite imagery/ video	Healthy seagrass bed on a soft substrate interspersed with scattered patches of macroalgae.	Medium
Reef flat with variable density of corals	Dive	Heterogeneous reef substrate (reef patches to unconsolidated dead banks with sand) with highly variable coral diversity and density. Eastern part of the reef flat is subject to high sedimentation rates while the western part has very clear waters.	Low to high
Shallow reef rock	Dive/satellite imagery	Sand patches and reef rocks with sparse living corals and dense <i>Sargassum</i> sp algae on the coastal area.	Low to medium
Tidal mudflat	Satellite imagery	Coastal mudflats associated to mangroves and likely support endobenthic fauna	Low to medium

Habitat type	Data acquisition	Habitat description	Sensitivity
Shallow sand lagoon with seagrass beds	Satellite imagery/literature	Submerged sandbank with dense seagrass meadows according to the literature	Low to high
Soft seabed	Satellite imagery	Probably soft sediment with an increasing proportion of mud towards the edge of the reef.	Low

Marine Sensitive Species

Opportunistic observations of megafauna were made in the whole study area, but no acoustic detections of mammals were registered. Desktop review and field surveys undertaken in 2016 and 2017 identified 35 marine species of conservation concern that are known or considered likely to occur within the study area. These comprise:

- 5 species of elasmobranchs (cartilaginous fish), including sharks, rays and sawfish, as well as sea turtles listed as Critically Endangered on the IUCN Red List
- 8 species of elasmobranchs, sea turtles and sea cucumbers listed as Endangered
- 13 species listed as Vulnerable
- 9 species listed as Near Threatened.

The migratory ornate lobster (*Panulirus ornatus*) is considered to be particularly at risk as its migratory pathway overlaps with the offshore export pipeline corridor.

eDNA surveys conducted in 2023 collected samples from Caution Bay, in the offshore corridor area and in Orokelo Bay. Two IUCN Red List fish species and two IUCN Red List vertebrate species were recorded.

The Marine EBS (2024) recorded 2,922 individuals belonging to 21 different taxonomic groups. One IUCN reptile species was recorded along with one IUCN NT and one IUCN CR fish species. 60 seabirds (IUCN LC) from seven species were recorded.

Marine ecology surveys were undertaken along the Kutubu Export Pipeline Route and PLEM anchor pile sites as part of the Pre-Construction Survey Report - Offshore Pipeline (2025). These surveys are representative of the portion of the condensate pipeline corridor connecting to the FSO facility.

The PCS Offshore Pipeline (2025) analysed ten benthic infauna samples. The survey found 4,154 meiofauna and 153 macrofauna individuals across 27 families. Baited remote underwater video systems were used to record pelagic fauna present in the area, with twelve species identified including squid, ray finned fishes and elasmobranchs. The survey identified three IUCN listed sharks, including Blacktip shark (*Carcharhinus limbatus*) (Vulnerable), Scalloped hammerhead (*Sphyrna lewini*) (Critically Endangered) and Dusky shark (*Carcharhinus obscurus*) (Endangered).

Marine surface fauna sightings included Indo-Pacific bottlenose dolphins (*Tursiops aduncus*), five bird species, flying fish and bull sharks (*Carcharhinus leucas*) (IUCN listed as vulnerable).

The Marine CHA (2025) identified ten species that meet IFC PS6 Critical Habitat criteria and thresholds under Criterion 1-3. They include one IUCN CR plant species (*Bruguiera hainesii*), one IUCN EN reptile species (*Chelonia mydas*), and one IUCN VU shark species (*Hemiscyllium hallstromi*) under Criterion 1. Critical Habitat Criterion 2 thresholds are met by one IUCN NT reptile species (*Laticauda guineai*), one DD₁ reptile (*Djokoiskandarus annulata*), one IUCN LC fish (*Heteroconger cobra*), one DD₁ fish (*Scomberomorus multiradiatus*), and one IUCN NT ray (*Pateobatis hortlei*) species. Criterion 3 thresholds are met by one IUCN EN bird (*Charadrius mongolus*), one LC arthropod (*Panulirus ornatus*). See Figure 6-40, Figure 6-41 and Figure 6-42 below for a selection of marine species identified during baseline surveys.



Photo: CSIRO, 2016 (Robert Kerton).

Figure 6-40: Migratory ornate lobster (Source: EIS Impacts Marine, 2019)



Bird-wire cod (*Epinephelus merra*)



Saddled butterflyfish (*Chaetodon ephippium*)



Moorish idol (*Zanclus cornutus*)



Dot-dash goatfish (*Purapeneus barberinus*)

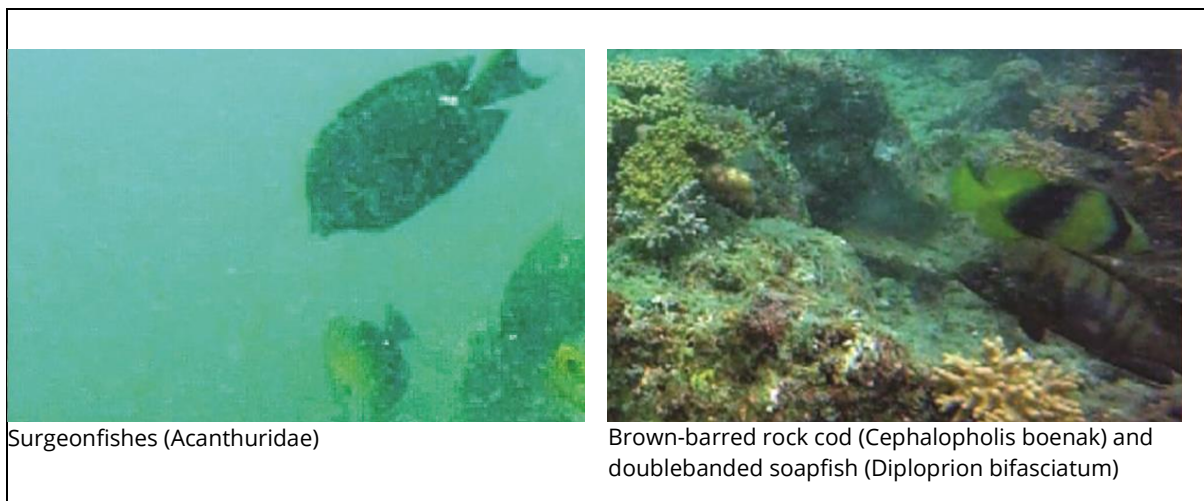


Figure 6-41: Examples of reef fish (Source: EIS Impacts Marine, 2019)



Figure 6-42: Deep water coral reef communities (Source: EIS Impacts Marine, 2019)

Invasive Species

As per the FEED Changes EAR (2025), few invasive or introduced species have been documented in PNG; however, many of the reef-associated species of northern Australia and the Great Barrier Reef are common to PNG. Current marine pests of northern Australia include the Asian green mussel (*Perna viridis*) and Caribbean tubeworm (*Hydroides sanctaecrucis*). *Acanthaster planci* (crown-of thorns seastar), although native to the Indo-Pacific reefs, can be considered an invasive species when in high abundance and can devastate coral reefs.

6.18.3 Impact Assessment

The following impacts may arise during the construction and operations phases as identified in the EIS (2019) and FEED Changes EAR (2025):

- Loss or disturbance of benthic habitats and marine fauna from trenching and pipelaying.
- Barrier effect and habitat fragmentation (benthic fauna) over time due to the presence of the pipeline where it will protrude over the seabed by about 30 inches.

- Temporary increase in sediment concentrations and deposition rates (trenching).
- Spread of marine pests and diseases due to vessels during construction and operation.
- Vessel strike causing injury or fatalities to marine fauna.
- Physiological injury or behavioural disturbance to aquatic fauna due to underwater noise from construction vessels, pipelaying, HDD (drilling and jack-up barge) and PLEM piling.
- Toxicity effects on aquatic fauna due to:
 - o Planned wastewater discharges (hydrotest water, vessel domestic water and bilge water).
 - o Accidental hydrocarbon or chemical spills.

6.18.4 Mitigation

The FEED Changes EAR (2025), outlines the following management measures to reduce impacts to marine biodiversity:

- Project Surface and Groundwater Management Procedure.
- Project Chemical and Hazardous Materials Management Procedure.
- Project Spills and Accidental Release Management Procedure.
- Project Noise and Vibration Management Procedure.
- Project Traffic and Transport Management Procedure
- Project Ecology Management Procedure.
- Inshore Dolphin Management Procedure.

Table 6-63 below describes mitigation and management measures to reduce impacts to marine habitats, flora and fauna species. Mitigation and management in Caution Bay in the lease area for the PNG LNG Project is to be further aligned with the PNG LNG Project and downstream Papua LNG project. Mitigation measures align with commitments in the Ecological Management Plan.

Table 6-63: Mitigation measures - Marine biodiversity

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
Direct loss of benthic habitat and loss of or injury to marine fauna from trenching, pipelaying and sedimentation	EM037	Minimisation	Where required, implement adaptive management to minimise dredging impacts on sensitive habitats and species.	<i>EIS/ Upstream CESMP; 2019</i>
Contaminant releases	ED022	Minimisation	Ballast waters, liquid effluents and waste from vessels will be managed in accordance with the MARPOL 73/78 requirements.	<i>EIS/ Upstream CESMP; 2019</i>
	EM008	Minimisation	Sewage effluents from Project facilities will be treated to meet the environment (waste discharge) permit before discharge, in accordance with applicable standards.	<i>EIS/ Upstream CESMP; 2019</i>
	EM015	Minimisation	Hydrotest water management will consider: • The definition of volume and discharge rates and discharge locations. • Chemicals additives selection, according to requirements defined in embedded design controls. • Reusing hydrotest water to minimise the discharge volume. • Reducing the need for chemicals by minimising the time hydrotest water remains in the pipeline. • Monitoring hydrotest water discharges to the environment against applicable limits.	<i>EIS/ Upstream CESMP; 2019</i>
Vessels striking fauna	EM022	Minimisation	Implement lower speeds past aquatic fauna when observed in the water.	<i>EIS/ Upstream CESMP; 2019</i>
	EM028	Avoidance / Minimisation	All Project personnel, workers, contractors and 3rd party operators will be educated during inductions and safety training about: • Fire risks, including the heightened risk during extreme drought years and smoking. • Wildlife values. • Weed, pathogen and animal pest hygiene and control measures. • Identification of cultural heritage, cultural heritage awareness, measures for avoiding impacts and the Chance Finds Procedure.	<i>EIS/ Upstream CESMP; 2019</i>
Spread of marine pests, diseases and pathogens	EM023	Minimisation	Management controls will be developed for weed, pathogen and pest that pose a significant threat to biodiversity, including: • Specific risk-based control methods, and procedures targeting Priority 1 and 2 weeds and pest fauna. • A quarantine management program for moving people, equipment and supplies in accordance with PNG law. • Tools for field personnel to identify Priority 1 and 2 weeds and pest fauna.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
	EM028	Avoidance / Minimisation	As Above	<i>EIS/ Upstream CESMP; 2019</i>
Unplanned releases	EM018	Minimisation	An Emergency Response Plan will be developed to effectively manage the preparedness and response to emergency events. It will contain: - Site contingency plans, that will consider fire management measures. - An Oil Spill Contingency Plan, that will consider spill risks for construction, operation and decommissioning of facilities and associated infrastructure, and supply services on land and in aquatic and marine environments. - A Blow Out Contingency Plan including well blowout control and contingency measures.	<i>EIS/ Upstream CESMP; 2019</i>
	EM019	Minimisation	Vessels will be required to have shipboard Oil Pollution Emergency Plans/Oil Spill Contingency Plans as per TotalEnergies' requirements and Marine Pollution (Ships and Installations) Act 2013.	<i>EIS/ Upstream CESMP; 2019</i>
Underwater piling	EM039	Minimisation	Provide for a 'soft start' for impact hammer piling activities to allow transitory and resident fauna nearby the opportunity to move away before sound levels reach maximum levels.	<i>EIS/ Upstream CESMP; 2019</i>
	EM040	Minimisation	If noise-sensitive aquatic species are sighted during piling, initiate shutdown and stop operations until the animal leaves the noise exclusion zone or a set period has passed; visually monitor for dead or injured aquatic fauna.	<i>EIS/ Upstream CESMP; 2019</i>
Drilling fluids	TBC	Minimisation	For Caution Bay shore crossing by HDD, additional mitigation measures have been identified. Specifically, the risk of occurrence of frac outs during HDD will be minimised by: - Conducting detailed geotechnical investigations to understand ground conditions along bore path to inform assessment of the risk of frac out and avoid paths in weak zones. - Installing casing at the entry point where reduced cover and bearing pressure exists. - Continual monitoring of drilling fluid pressures and losses during drilling and if unexpected variations or trends are observed cease drilling, investigate causes and implement remedial measures.	<i>FEED Changes EAR; 2025</i>
Loss of individual migratory shorebirds, resident marine coastal birds and freshwater wetland birds and disturbance to feeding or roosting	EM019	Minimisation	As above	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Mitigation Hierarchy Action	Description	Source document
congregations and breeding sites				

6.18.5 Residual Impacts

Following the application of mitigation, residual impacts to marine receptors are of Negligible to Minor significance.

The EIS (2019) identified potentially significant residual impacts from the pipeline to the migration of the ornate rock lobster (*Panulirus ornatus*), which regularly migrates from the Torres Strait, through the Gulf of Papua to the Yule Island spawning grounds. However, since the EIS (2019), the diameter of the gas export pipeline has been reduced from 40 inches to 30 inches. The EIS (2019) summarised that “Dennis et al. (1996) demonstrated that lobsters can cross a 26-inch diameter pipeline to access a food source in experiments conducted in test tanks. The diameter of the existing PNG LNG Gas Pipeline [Exxon Mobil project] is 34 inches and there is no evidence to indicate it has presented a barrier to lobster migration to Yule Island causing impacts on lobster populations, with the National Fisheries Authority not receiving any reports of negative impacts to lobster catches following its installation (Kasu, pers. com., 2019)”.

It is therefore assumed that the revised 30-inch gas export pipeline for the Project will not pose significant residual impact during operation, although this should be confirmed through the Project’s biodiversity monitoring plans.

The Net Gain Feasibility Study (2025) identified that an estimate 16.6ha is required to offset Project impacts at Caution Bay particularly to the coral reef habitats. The Project has already significantly reduced potential losses of coral reef by opting for HDD over trenching as the construction methodology.

Table 6-64 presents residual impacts to marine biodiversity in relation to Project activities.

Table 6-64: Summary of potential residual impacts for marine biodiversity . (Source(s): FEED Changes EAR (2025) and EIS Impacts Marine (2019))

Key Sensitivity	Main Activity	Potential Impact	Project Phase	Mitigation and Management	Residual Assessment	
					Sensitivity/Magnitude	Significance
Marine fauna species	- Condensate pipeline to FSO - Export pipeline route realignment - Reduced diameter of export pipeline	Pipeline barrier to marine fauna movements	O, D	None	Medium/Low	Minor
	Offshore pipeline construction – trenching for the pipeline in Orokolo Bay	Mobilisation of sediments: Increased suspended concentrations in water column	C	EM037	Low / Low	Minor
		Mobilisation of sediments: Increased suspended sediment seabed	C		Low / Low	Minor
			C		Medium / Low	Minor
	- Planned wastewater discharges, accidental contaminant releases and losses of drilling fluids - Controlled discharges of hydrotest water, vessel domestic wastewater and bilge water	Deterioration in marine water quality (flatback turtles, spotted eagle-rays and brown marbled groupers)	C, O	EM008 EM015 ED022 EM018 EM019	Medium/Minimal	Negligible
	Project vessel operations	Marine fauna mortality or injury from vessel strikes-leatherback turtles	C, O, D	EM022 EM023 EM028	Very High/Minimal	Minor

Key Sensitivity	Main Activity	Potential Impact	Project Phase	Mitigation and Management	Residual Assessment	
					Sensitivity/Magnitude	Significance
		and hawksbill turtles		EM039 EM040		
		Marine fauna mortality or injury from vessel strikes-loggerhead turtles, green turtles, olive ridley turtles, dugongs, Australian snubfin dolphins and Australian humpback dolphins			High/Minimal	Minor
		Marine fauna mortality or injury from vessel strikes-flatback turtles			Medium/Minimal	Negligible
		Marine fauna mortality or injury from vessel strikes-non-threatened dolphin species			Low/Minimal	Negligible
Native fauna species	Project vehicle operations	Introduction of pests and diseases that cause mortality and replacement of native fauna	C, O, D	EM023 EM028	Medium / Low	Minor
Marine habitats and benthic	Trenching in water depths <-20m (lowest Astronomical Tide) LAT and pipelaying	Direct loss of seagrass habitat	C	EM037	Medium / Low	Minor

Key Sensitivity	Main Activity	Potential Impact	Project Phase	Mitigation and Management	Residual Assessment	
					Sensitivity/Magnitude	Significance
biota		Direct loss of coral reef habitat			Medium / medium	Moderate
		Indirect impacts to marine fauna due to habitat loss (e.g., decrease in health due to a reduction in food resources)- leatherback turtles and hawksbill turtles			Very High / Minimal	Minor
		Indirect impacts to marine fauna due to habitat loss (e.g., decrease in health due to a reduction in food resources)- loggerhead turtles, green turtles, olive ridley turtles and dugongs			High / Minimal	Minor
		Indirect impacts to marine fauna due to habitat loss (e.g., decrease in health due to a reduction in food resources)- flatback turtles, spotted eagle-rays and brown marbled groupers			Medium / Minimal	Negligible

Key Sensitivity	Main Activity	Potential Impact	Project Phase	Mitigation and Management	Residual Assessment	
					Sensitivity/Magnitude	Significance
		Indirect impacts to marine fauna due to habitat loss (e.g., decrease in health due to a reduction in food resources)- non-listed fish species			Minimal – Low/ Minimal	Negligible
		Direct mortality or injury of benthic invertebrates			Minimal / Low	Negligible
Water quality	- Accidental releases of hydrocarbons and chemicals - Spill or leak of hydrocarbons and chemicals from vessels	Deterioration in marine water quality	C, O, D	EM018 EM019	Medium / Low	Minor
	Leaks of condensate or gas from pipeline joint	Deterioration in marine water quality	O	None	Medium / Low	Minor

Notes: C = construction, O = operations, D = decommissioning

6.19 Ecosystem Services

6.19.1 Introduction

This section presents a synthesis of Project documentation relating to ecosystem services. Ecosystem services are the benefits that people (or beneficiaries) derive from ecosystems. Biodiversity comprises the habitats, species and genetic material that form the basis of ecosystems, thereby underpinning all ecosystem services (IPIECA and IOGP, 2011). They represent the intersection of the natural and human environment and play a vital role in individual and community wellbeing. This section summarises the main assessments and findings from existing surveys, including the EIS (2019) and the ESA (2025).

The IFC, among other guidelines, divides Type I and II ecosystem services. Type I ecosystem services are those services on which projects and operations are most likely to have an impact and, therefore, could result in adverse impacts on communities and Type II ecosystem services are those on which the Project directly depends for its operations. Type I and II ecosystem services can be divided into four categories (IFC, 2019):

- Provisioning ecosystem services: the products people obtain from ecosystems including, among others, (i) agricultural products, seafood and game, wild foods, and ethnobotanical plants; (ii) water for drinking, irrigation, and industrial purposes; and (iii) forest areas, which provide the basis for many biopharmaceuticals, construction materials, and biomass for renewable energy.
- Regulating ecosystem services: the benefits people obtain from the regulation of ecosystem processes including, among others, (i) climate regulation and carbon storage and sequestration; (ii) waste decomposition and detoxification; (iii) purification of water and air; (iv) control of pests, disease, and pollination; and (v) natural hazard mitigation.
- Cultural services: the nonmaterial benefits people obtain from ecosystems including, among others, (i) spiritual and sacred sites; (ii) recreational purposes such as sport, hunting, fishing, and ecotourism; and (iii) scientific exploration and education.¹¹
- Supporting services: the natural processes that maintain the other services, such as (i) nutrient capture and recycling, (ii) primary production, and (iii) pathways for genetic exchange.

Priority ecosystem services (PES) may result in adverse health and safety impacts to Affected Communities (Type I impacts) or significantly affect project viability (Type II dependencies).

Table 6-65: Preliminary list of ecosystem services identified

Provisioning Services	Regulating and maintaining services
Wild food (bushmeat)	Control of erosion and sedimentation
Wild food (plants, nuts and fruit)	Regulation of surface and groundwater (including flows)
Wild food (freshwater and marine species)	Regulation of natural hazards
Food (crops)	Regulation of air quality
Food (livestock)	Regulation of climate
Fuel (firewood)	Water purification and waste treatment

¹¹ Some ecosystem services have intrinsic or non-use values, such as traditional knowledge, cultural and spiritual fulfilment, connection to place, sense of identity and a sense of responsibility for caring for the environment and the spirits that are believed to exist there. These services still provide benefits to beneficiaries and contribute to wellbeing even though Affected Communities may not physically visit or access the areas being impacted.

Provisioning Services	Regulating and maintaining services
Traditional medicine	Regulation of soil quality
Timber and other wood products	Regulation of diseases
	Regulation of pests
	Seed bank for natural regeneration
	Pollination and seed dispersal
Cultural services	Supporting services
Cultural sites	Provision of habitat for plant and animal species
Traditional practices	Nutrient cycling
	Primary production
	Water cycling
	Soil formation
	Genetic resources

The Papua LNG Biodiversity and Ecosystem Services Strategy, hereafter referred to as BESS (2023) has the overarching objective for the Project *“to achieve a measurable and long-term Net Gain in Critical Habitat-qualifying features (e.g., species and ecosystems) and to maintain the value and functionality of priority ecosystem services that may be impacted by its operations.”*

6.19.2 Baseline

Baseline was conducted as part of the EIS (2019) where surveys were conducted in eleven villages as well as targeted group discussions in nine villages. Detailed methodology can be found in EIS Vol. 2 Part 18 Upstream Land & Natural Resources Baseline (2017). The ecosystem services baseline was described within the ESA (2025).

The Project is located in a largely rural, subsistence-based landscape in Gulf Province where inland Pawaian, Purari River, and Orokelo coastal communities depend heavily on local ecosystems for food, materials, cultural practices, and wellbeing. Ecological zones include hill forests, alluvial and swamp forests, sago and nipa swamps, mangroves, rivers, and coastal/estuarine environments, each supporting distinct bundles of provisioning, regulating, cultural and supporting services. Affected Communities are the primary beneficiaries and are differentiated as inland versus coastal/riverine users to reflect differing access to and reliance on forest, river and coastal resources. Commercial users (e.g. logging, commercial fisheries) were excluded from the ecosystem services scope. Baseline consultation to date has focused more on describing resource use and livelihoods than on structured assessments of wellbeing or community-led prioritisation of services, and much of the original data is from 2016.

Provisioning services form a core part of the baseline, especially subsistence food and material supply from forests, swamps and rivers. Inland and river communities hunt wild pigs, cassowary, bush fowl, monitor lizards, bandicoots, cuscus, possums, flying fox and other wildlife, and harvest insect larvae and sago grubs, with logging in some areas already pushing hunting further from villages. Along the Purari River, people rely on wild plant foods (particularly wild sago in swamp forests), as well as medicinal plants used to treat common ailments, though riverine communities report fewer medicinal plant uses than hill-forest Pawaian villages. The Purari River and tributary creeks provide key aquatic foods including tilapia, mahseer, catfish, barramundi, prawns, turtles and crocodiles, with catches reflecting a transition from freshwater to brackish/marine species downstream towards Aivai and Aumu.

Regulating, supporting and cultural services provide essential but less directly visible contributions to baseline wellbeing. Intact forests and vegetated slopes contribute to erosion control, natural hazard

regulation (floods, landslips) and maintenance of water quality, thereby supporting both community livelihoods and the integrity of existing infrastructure. Supporting services such as habitat provision, nutrient cycling and primary production underpin the supply of food and cultural species, although the assessment focuses on end services rather than these intermediate ecological processes. Cultural and spiritual connections to land, rivers, forests and species are recognised as important to identity and wellbeing, and the updated ESA seeks to provide additional detail on cultural services and non-use values through further fieldwork and targeted consultation.

For Type II (project-dependence) services, the baseline identifies those ecosystem services that the Project relies upon for its operational performance and that therefore form part of the ecosystem services context. Most local provisioning services used by communities (wild foods, timber, biochemicals) are baseline community assets but are not operational dependencies for the Project, because food and many materials will be imported. In contrast, raw geological materials (aggregate, sand, soil and clay) sourced largely within the upstream area, and freshwater (including Purari River flows, creeks, groundwater and rainwater) for construction, processing and drilling are baseline services on which the Project is directly dependent. These have been identified as Type II priority ecosystem services because unsustainable extraction or changes in river timing and flow could significantly affect project viability, particularly for barging operations and construction-phase water supply.

Table 6-66 summarises PES, as described in the ESA (2025).

Table 6-66: Priority ecosystem services (Source: ESA (2025))

Priority ecosystem service type	Service name	Rationale in baseline
Type I (community-facing)	Food – wild animals	High importance for subsistence protein; affected by forest clearing and existing logging pressures.
Type I (community-facing)	Food – wild plants (incl. wild sago)	Critical supplementary food, especially for households with limited gardens; sensitive to land access and restrictions.
Type I (community-facing)	Food – aquatic species (fish, prawns, turtles, crocodiles)	Major protein source along Purari River; vulnerable to water quality changes and accidental contamination.
Type I (community-facing)	Traditional medicine – wild plants	Supports basic health care; access constrained where forest access is reduced.
Type I (community-facing)	Key cultural and spiritual services (sites, species, landscapes)	Important for identity and wellbeing; under-represented in earlier baseline and to be further detailed through consultation.
Type II (project-dependence)	Raw material – geological (aggregate, sand, soil, clay)	Required for construction of roads, CPF and other infrastructure; overuse could constrain project performance.
Type II (project-dependence)	Water timing and flow (Purari River and other freshwater)	Essential for barging, construction and processing water supply; limited viable alternatives during construction.

Additional baseline collection through consultation with Purari River and Orokelo communities is planned in 2026, and PES identification will be finalised once that targeted engagement is complete.

6.19.3 Impact Assessment

The ESA (2025) is a “living document” that updates the earlier work in the EIS (2019) by incorporating new field studies (e.g. fisheries, cultural heritage mapping, updated community information), adding formal methods and results for Type II services, and anchoring PES identification and impact characterisation in ongoing, village-level consultation and an ecosystem services field program.

The ESA's impact assessment systematically examines Type I ecosystem services (those where project impacts could affect communities) for different community groups starting from ecological zones and land-use types and then describing, for each service, how Project activities may alter provision, access, or use.

Table 6-67 describes Project impacts on PES, as per the ESA (2025).

Table 6-67: Impact assessment on priority ecosystem services (Source: ESA (2025))

Project impact pathway	Main activities/processes	Ecosystem services affected (PES focus)	Impact on PES and beneficiaries
Vegetation clearing and land acquisition (wellpads, CPF, roads, pipeline ROW, camps)	Land access, forest and swamp clearing, creation of rights-of-way, safety/exclusion zones	Type I: Food – wild animals; Food – wild plants (incl. wild sago); Traditional medicine; Cultural/spiritual sites and landscapes; Supporting services (habitat, primary production)	Direct loss and fragmentation of alluvial, swamp and hill forests reduces habitat for hunted species and availability of wild foods and medicinal plants, and can shift hunting and gathering further from villages; restrictions on access to cleared or secured areas can limit community use of customary lands and some cultural sites; underlying ecological functions that support PES are diminished where extensive or repeated clearing occurs.
Construction disturbance (noise, traffic, presence of workforce)	Vehicle and machinery operation, temporary camps, human presence, lighting, noise	Type I: Food – wild animals; Cultural services (sense of place, tranquillity); Regulating services (disturbance to fauna)	Disturbance can cause game species and culturally important wildlife to move away from traditional hunting areas, reducing hunting success near project footprints; changes in soundscape and increased human presence can reduce perceived quality of culturally important landscapes and create tensions around access and use.
Earthworks, erosion and mass movement risk	Cut-and-fill on ridges and slopes, new and upgraded roads, pipeline trenching	Type I: Regulating services (erosion control, slope stability, water quality regulation); Food – aquatic species; Supporting services (soil formation, habitat)	Slope modification and vegetation removal increase susceptibility to landslides and erosion, which in turn can increase sedimentation in downstream creeks and rivers; this can degrade aquatic habitats and affect fish and other aquatic resources important to communities, while also undermining the regulating role of intact vegetation and soils.
Hydrological alteration and water extraction	Intake structures, weirs or dams on	Type I: Food – aquatic species; Domestic and livelihood water	Changes to flow regimes and local water levels can affect fish, prawns, turtles and other aquatic species relied upon for subsistence, and may influence

Project impact pathway	Main activities/processes	Ecosystem services affected (PES focus)	Impact on PES and beneficiaries
	small streams, abstraction from rivers/creeks, dewatering, temporary diversions	use; Cultural uses of water bodies; Regulating services (flow regulation, water quality); Type II: Water timing and flow (project dependence)	navigation and cultural practices on watercourses; abstraction and small structures can alter seasonal availability of water for communities; For the Project, any reduction in reliable flows along key reaches (e.g. for barging routes) can create operational risks, leading to the designation of water timing and flow as a Type II PES.
Dredging and in-river works (Purari River and tributaries)	Dredging for navigation and aggregate, vessel movements, in-river infrastructure	Type I: Food – aquatic species; Cultural heritage and spiritual sites; Regulating services (sediment and habitat dynamics); Type II: Water timing and flow (navigability)	Dredging can directly disturb fish and other aquatic biota, modify habitats and turbidity, and temporarily affect fishing success; it may also threaten or degrade cultural heritage features and spiritually significant locations along the Purari River where residual impact significance has been rated as moderate or higher (e.g. Kaevaria at the Purivo Junction); Maintaining navigable depth is also a key condition for project logistics, so changes in sediment dynamics and channel form have implications for the project's dependence on this service.
Quarrying, borrow pits and raw material sourcing	Extraction of aggregate, sand, soil and clay from local and regional sources, including riverine deposits	Type II: Raw material – geological (project dependence); Type I: Regulating/supporting services where local sites are used	Unsustainable extraction at local sites can deplete accessible construction materials, increase costs and logistics complexity, and create instability or erosion at extraction areas; the ESA therefore classifies raw geological materials as a Type II PES and recommends efficiency measures and diversified sourcing (including off-site quarries) to reduce risk; Where local sites overlap with community resource areas, there is also potential for localised effects on regulating/supporting services.
Water and sediment quality degradation (accidental or chronic)	Spills, leaks, poor erosion/sediment control, waste and wastewater mismanagement, fuel and chemical handling	Type I: Food – aquatic species; Domestic water use; Cultural uses of rivers/creeks	Accidental contamination of rivers and creeks could render fish, shellfish and other aquatic species unsafe or less desirable, and limit communities' willingness to use watercourses for drinking, washing or cultural activities; this pathway is identified as a key risk for Purari River communities, with wellbeing impacts to be detailed through ongoing consultation.
River and marine transport interaction with community use	Barges and other project vessels using the Purari River and coastal routes	Type I: River transport as a service for communities (screened out as non-PES in current ESA); Cultural and recreational services	While river transport is recognised as important for local communities, the ESA notes that project-related effects on this service were not rated as significant residual impacts (moderate or higher) in the EIS, so it is not currently treated as a PES; nevertheless, increased traffic and safety zones can indirectly affect access to fishing grounds and river travel patterns. Rf. to sections 6.12 and 6.15 where this is assessed.

Project impact pathway	Main activities/processes	Ecosystem services affected (PES focus)	Impact on PES and beneficiaries
Cultural change and social dynamics	Influx of project workers, changes in livelihoods, renewed external engagement in remote communities	Type I: Cultural services (language, traditional knowledge, spiritual practices, sense of place)	The ESA flags potential for project-induced changes in language use (notably Pawaia) and transmission of traditional ecological knowledge, as well as shifts in the cultural value of land and rivers if access and use patterns change. It also flags disturbance to known and unknown sites and ancestral remains during construction. Changes in access to cultural places may affect practices and identity, while project engagement and training may influence community dynamics and knowledge systems

6.19.4 Mitigation

As per the ESA (2025), mitigation for Project impacts to ecosystem services will largely be delivered through the management controls described in the EIS (2019) and CESMP. The majority of relevant mitigation is already embedded in design and management plans.

Table 6-68 below describes planned mitigation measures according to the ESA (2025):

Table 6-68: Mitigation measures - Ecosystem services

Impact	Mitigation code (As in MP)	Description	Source document
Vegetation clearing and land acquisition for wellpads, CPF, roads and pipelines	ESM001	Assess the efficacy of efficient biomass stove programs in coastal PNG and, if warranted, support extension services to promote their use in the PAol in Orokolo Bay.	<i>EIS/ Upstream CESMP; 2019</i>
	EM025	Minimise damage to habitat surrounding planned footprints by safely felling trees into planned footprints or into less environmentally sensitive natural spaces between standing trees.	<i>EIS/ Upstream CESMP; 2019</i>
	EM001	All sites proposed for development as part of the Project will be subject to a preconstruction survey to clearly identify acid sulphate soils, sensitive sites and habitats, e.g. roosting, breeding, nesting and threatened species sites, priority ecosystem services, archaeological sites, burial sites, sites of religious importance to be subject to specific mitigation measures.	<i>EIS/ Upstream CESMP; 2019</i>
	EM029	Actively or passively rehabilitating bare sites as soon as possible to promote a stable self-sustaining landscape. e.g.: • Allow forest edges to naturally regenerate or create appropriate conditions to facilitate natural regeneration, e.g. rip the substrate, replace topsoil, apply mulch. • Rehabilitate Pandanus habitats, e.g. recreate mounds, re-instate the intertidal surface between Pandanus mounds. • Rip compact surfaces across the slope, as appropriate, to facilitate revegetation and minimise erosion. • Spread stockpiled topsoil, organic matter and cleared vegetation over the rehabilitation area to promote natural regeneration. • Use native vegetation to revegetate sites when active rehabilitation measures are required.	<i>EIS/ Upstream CESMP; 2019</i>
	EM024	Maintain a minimum practical distance from sensitive features to minimise potential degradation and disturbance. Buffer distances shall be ecologically relevant, considering:	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		- Sensitive habitats, i.e. primary alluvial forest, mangroves, riparian vegetation along forest streams. - Habitats that provide focal breeding, roosting or feeding sites for sensitive fauna, e.g. caves, rock shelters, rock outcrops, large trees with hollows, large trees with nests, bird-of-paradise display trees, forest pools, large fig trees (<i>Ficus</i> spp.) and vines of the family Aristolochiaceae. - Sites that support populations of IUCN Threatened or rare and localised plant species.	
Earthworks, erosion and mass movement risk	EM004	Erosion and sediment control measures will be implemented for infrastructure components in accordance with good international industry practice to effectively manage stream and river flows, stormwater, surface erosion, sedimentation and scour, e.g. drainage diversion into surrounding vegetation, rip-rap aprons, rock armoring, energy dissipators, sediment control ponds, mulch berms and sediment fences, where required, until the area has been effectively stabilised and/or rehabilitated.	<i>EIS/ Upstream CESMP; 2019</i>
	EM006	Areas of higher risk of landslides e.g., steep gradients, previously disturbed land, likely to occur from the works, or likely to be exacerbated by the works, will be stabilised to reduce the landslide risk.	<i>EIS/ Upstream CESMP; 2019</i>
Hydrological alteration and water extraction (creeks, Purari and other rivers)	EM020	Maintain hydraulic and biological connectivity during construction and operations in natural flow lines across linear infrastructure, such as pipelines and roads, and in relation to water extraction, e.g. dams, including: - Install appropriately sized culverts, drains and structures to allow fish passage, according to good international industry practice standards. - Rehabilitate waterways after construction and decommissioning to a sustainable, stable state, that reflects the original character, and maintains waterway flows and connectivity.	<i>EIS/ Upstream CESMP; 2019</i>
	EM011	Water from trenches will be discharged in accordance with applicable water quality standards with erosion and sediment controls where relevant.	<i>EIS/ Upstream CESMP; 2019</i>
	EM015	Hydrotest water management will consider:	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		- The definition of volume and discharge rates and discharge locations. - Chemicals additives selection, according to requirements defined in embedded design controls. - Reusing hydrotest water to minimise the discharge volume. - Reducing the need for chemicals by minimising the time hydrotest water remains in the pipeline. - Monitoring hydrotest water discharges to the environment against applicable limits.	
Dredging and in-river works on the Purari (navigation, aggregate)	EM037	Where required, implement adaptive management to minimise dredging impacts on sensitive habitats and species.	<i>EIS/ Upstream CESMP; 2019</i>
	CHM001	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM014	Implement low speed limits through areas sensitive to vessel wash impacts.	<i>EIS/ Upstream CESMP; 2019</i>
Quarrying, borrow pits, raw material sourcing	EM005	Stabilise spoil stockpiles and areas of ground disturbance as soon as practicable after initial disturbance using, e.g., mulched vegetation, aggregates and soil binders.	<i>EIS/ Upstream CESMP; 2019</i>
	EM009	Backfill trenches as soon as practicable after disturbance, using material originally excavated from the trench as much as possible. The backfilled trenches should not exceed the preconstruction levels after the material has settled.	<i>EIS/ Upstream CESMP; 2019</i>
	EM002	Progressively clear vegetation and rehabilitate cleared areas as soon as practicable to minimise the time cleared areas are exposed; and allow fauna to move away from areas to be cleared, where practicable.	<i>EIS/ Upstream CESMP; 2019</i>
Water and sediment quality degradation from spills,	ED003	Adopt standard industry practices to prevent and protect against soil/water contamination, due to Project activities, such as: Preparing hydrocarbon and chemical management procedures, as part of the Hazardous Materials Management Plan.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
leaks, poor controls		• Building infrastructure on impervious surfaces where required. • Providing permanent fuel and chemical stores, and maintenance and refuelling areas with secondary containment of an appropriate volume to prevent loss to the environment or mixing with incompatible materials. • Installing interceptor pits or similar to collect contaminated surface water runoff and treat where required. • Installing tanks above ground with impermeable liners and bunds around tanks. • Regularly inspect and maintain the containers, storage and transfer infrastructure to prevent/control spills or leaks. • Installing readily accessible spill kits and training staff in their use. • Appropriately treating and disposing of any accidentally contaminated soils.	
	EM018	An Emergency Response Plan will be developed to effectively manage the preparedness and response to emergency events. It will contain: • Site Contingency Plans, that will consider fire management measures. • An Oil Spill Contingency Plan, that will consider spill risks for construction, operation and decommissioning of facilities and associated infrastructure, and supply services on land and in aquatic and marine environments. • A Blow Out Contingency Plan including well blowout control and contingency measures.	<i>EIS/ Upstream CESMP; 2019</i>
	EM019	Vessels will be required to have shipboard Oil Pollution Emergency Plans/Oil Spill Contingency Plans as per TotalEnergies requirements and Marine Pollution (Ships and Installations) Act 2013.	<i>EIS/ Upstream CESMP; 2019</i>
	EM004	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM011	See above	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
	ED022	Ballast waters, liquid effluents and waste from vessels will be managed according to the MARPOL 73/78 requirements.	<i>EIS/ Upstream CESMP; 2019</i>
	EM008	Sewage effluents from Project facilities will be treated to meet the environment (waste discharge) permit before discharge, in accordance with applicable standards.	<i>EIS/ Upstream CESMP; 2019</i>
	ED006	Minimise chemical use and select chemicals considering the following criteria: - lowest toxicity, lowest bioaccumulation potential and highest biodegradation. - chemicals subject to bans or phase-outs.	<i>EIS/ Upstream CESMP; 2019</i>
	ED020	Rainwater infiltration into hazardous materials storage areas will be prevented.	<i>EIS/ Upstream CESMP; 2019</i>
	ED021	Requirements for hazardous material transfer, overfill protection, and alarms will be implemented, e.g.: - Using dedicated fittings, pipes, and hoses specific to materials in tanks. - Providing secondary containment, drip trays, etc. at connection points or other possible overflow points. - Using dripless hose connections for vehicle tank and fixed connections with storage tanks. - Providing automatic fill shutoff valves on storage tanks to prevent overfilling. - Using piping connections with automatic overfill protection (float valve). - Fitting tanks with high-level alarms with both audible and visible annunciation.	<i>EIS/ Upstream CESMP; 2019</i>
Cultural heritage and broader cultural change	CHM001	Develop and implement archaeological clearance procedures related to all early works and construction activities. This will include: - Establishment of a buffer area around identified sensitive sites near the planned project facilities, prior to early works and construction activities, to avoid accidental or inadvertent impacts. - Management of potential direct impact to any known site where impact is unavoidable, in consultation with local affected communities.	<i>EIS/ Upstream CESMP; 2019</i>

Impact	Mitigation code (As in MP)	Description	Source document
		- A Chance Finds Procedure for managing the discovery of ancestral remains, burial sites, and human remains. - Other measures, e.g. on site-specific recording, marking, erosion prevention, relocation, clearance distances and monitoring.	
	CHM003	Maintain traditional access to significant cultural places through consultation with relevant communities.	<i>EIS/ Upstream CESMP; 2019</i>
	CHM004	Appoint a Project Cultural Heritage Officer during the construction phase to oversee the implementation of the Chance Finds Procedure, to conduct training as appropriate and to act as key contact for Project workers and contractors on all matters related to cultural heritage.	<i>EIS/ Upstream CESMP; 2019</i>
	EM001	See above	<i>EIS/ Upstream CESMP; 2019</i>
	EM028	All Project personnel, workers, contractors and 3rd party operators will be educated during inductions and safety training about: - Fire risks, including the heightened risk during extreme drought years and smoking. - Wildlife values. - Weed, pathogen and animal pest hygiene and control measures. - Identification of cultural heritage, cultural heritage awareness, measures for avoiding impacts and the Chance Finds Procedure.	<i>EIS/ Upstream CESMP; 2019</i>
	ESM001	See above	<i>EIS/ Upstream CESMP; 2019</i>
	CHM005	Develop intangible cultural heritage workshops in collaboration with relevant PACs, with guidance and oversight provided by cultural heritage specialists.	<i>EIS/ Upstream CESMP; 2019</i>

6.19.5 Residual Impacts

Table 6-65 summarises residual impacts to ecosystem services. The ESA (2025) carries forward the EIS (2019) conclusion that, with embedded design and management controls, all residual impacts on ecosystem services are expected to be Negligible to Minor.

The ESA emphasises that the final assessment of residual significance for some ecosystem services will depend on the outcomes of the ongoing ecosystem services field program and future consultation; where that work reveals higher-than-anticipated residual effects on wellbeing, services may be reclassified as PES and their significance ratings revised accordingly.

Table 6-69: Summary of residual impacts - Ecosystem services

Ecosystem Service Category	Main Activity	Potential Impact	Component	Project Phase	Mitigation or Management Measure	Residual Sensitivity/ Magnitude	Residual Significance
Wild foods – plants	Vegetation clearing; onshore pipeline construction	Small, direct loss of wild plant foods in forest habitat near villages from land clearing along the export pipeline route, and an increase in time/effort required to source these foods.	Onshore export pipeline route	C	EM001 EM002 EM025 EM029 EM024 EM006 EM004 ESM001 EM005 EM009	High/Negligible	Negligible
Wild foods – plants	Vegetation clearing; onshore pipeline construction	Direct loss of wild sago near villages due to land clearing along the onshore export pipeline route.	Onshore export pipeline route	C	EM001 EM002 EM025 EM029 EM024 EM006 EM004 ESM001 EM005 EM009	High/Negligible	Negligible
Food – crops	Vegetation clearing; onshore pipeline construction	Small, direct loss of planted sago and food gardens near villages in Orokolo Bay due to land clearing along the onshore export pipeline route and shore crossing.	Onshore export pipeline route	C	EM001 EM002 EM025 EM029 EM024 EM006 EM004 ESM001 EM005	High/Negligible	Negligible

Ecosystem Service Category	Main Activity	Potential Impact	Component	Project Phase	Mitigation or Management Measure	Residual Sensitivity/ Magnitude	Residual Significance
					EM009		
Fuel (firewood)	Onshore pipeline construction	Reduced access to driftwood used for firewood during onshore export pipeline construction activities.	Onshore export pipeline route	C	ESM001	Medium/Negligible	Negligible
Timber and wood products	Vegetation clearing	Reduced availability of timber used for canoes and housing post construction identified near villages due to land clearing activities.	Onshore export pipeline route; PRL-15 river transport corridor	C	EM001 EM002 EM025 EM029 EM024 EM006 EM004 ESM001 EM005 EM009	Medium/Low	Minor
Timber and wood products	Vegetation clearing	Reduced availability of timber used for canoes and housing post construction identified near villages due to land clearing activities.	PRL-15 river transport corridor	C	EM001 EM002 EM025 EM029 EM024 EM006 EM004 ESM001 EM005 EM009	Low/Negligible	Negligible
Freshwater (domestic use)	Logistics transport	Reduced fresh water availability for domestic use due to accidental hydrocarbon release into the Purari River.	River transport corridor	C, O	ED003 EM018 EM019 EM004 EM011 EM008 ED006	High/Negligible	Negligible

Ecosystem Service Category	Main Activity	Potential Impact	Component	Project Phase	Mitigation or Management Measure	Residual Sensitivity/ Magnitude	Residual Significance
					ED020 ED021 EM020 EM015		
Commercial fisheries	Construction including trenching of export pipeline offshore; shore crossing construction	Reduced economic value of the Gulf of Papua Prawn Fishery due to water contamination from trenching activities or wastewater discharge.	Offshore export pipeline route	C	ED003 EM018 EM019 EM004 EM011 EM008 ED006 ED020 ED021 EM037 EM020 EM015	High/Negligible	Negligible
Commercial forestry	Vegetation clearing	Reduced harvestable timber from commercial concessions and loss of revenue for logging concession holders due to land clearing. Loss of royalties for landowners.	PRL-15; onshore export pipeline route	C, O	EM001 EM002 EM025 EM029 EM024 EM006 EM004 ESM001 EM005 EM009	Low/Medium	Minor
Commercial forestry	Vegetation clearing	Reduced harvestable timber from commercial concessions and loss of revenue for logging concession holders due to land clearing. Loss of royalties for landowners.	PRL-15; onshore export pipeline route	C, O	EM001 EM002 EM025 EM029 EM024	High/Low	Minor

Ecosystem Service Category	Main Activity	Potential Impact	Component	Project Phase	Mitigation or Management Measure	Residual Sensitivity/ Magnitude	Residual Significance
					EM006 EM004 ESM001 EM005 EM009		
Wild foods – freshwater and marine species	Offshore pipeline construction; logistics and transport (barging along the Purari River)	Reduced species abundance or availability for artisanal fishing in Orokolo Bay or the Purari River due to temporary contamination from pipeline, dredging or construction activities.	Offshore export pipeline route; river transport corridor	C, O	ED003 EM018 EM019 EM004 EM011 EM008 ED006 ED020 ED021 EM037 EM020 EM015	Medium/Low	Minor
Provisioning / Cultural Services	Dredging of the main river channel	Long-term loss of access to ecosystem services associated with sandbanks ¹² .	Aivai, Evara, Kaevaria, Poroi 1, Poroi 1	C, O	EM037 CHM001 CHM003 CHM004 CHM005 EM001 EM028 EM004 EM00	Medium /Low	Minor

¹² Dredging may result in localised hydrodynamic changes due to material removal from adjacent sandbanks; however, based on sediment loading levels, these changes are expected to be minor and temporary with no material impact on channel stability or access to sandbanks for resource collection. No changes are anticipated at other sandbank locations throughout the river.

Ecosystem Service Category	Main Activity	Potential Impact	Component	Project Phase	Mitigation or Management Measure	Residual Sensitivity/ Magnitude	Residual Significance
Regulating / Supporting Services	Dredging operations and vessel movement	Erosion of riverbanks and long-term loss of associated land and ecosystem services use ¹³ .	Whole river system / all communities	C, O	EM014 EM037 CHM001 CHM003 CHM004 CHM005 EM001 EM028 EM004 EM006	Medium /Low	Minor

Notes: C = construction, O = operations, D = decommissioning

¹³ Implementation of operational controls on vessel wake and adherence to assessed dredging limits subject to further morphological assessment if exceeded, will minimise the risk of erosion associated with project activities. Erosion from vessel wake is expected to be negligible due to operational controls. While minor erosion linked to morphological changes (e.g. channel realignment) may occur in isolated areas, this is anticipated to be minimal due to dredging within the existing channel and the continued presence of high sediment loads supporting natural accretion. Any erosion is expected to remain within the range of natural variability consistent with large-scale climatic events such as floods.

6.20 Indigenous Peoples

6.20.1 Introduction

This section synthesises the methodology and findings documented in the Project's existing source assessments and management plans relating to Indigenous Peoples. It does not introduce new impact ratings, residual impact conclusions, or independent analysis beyond the source material.

Although state and national legislation does not refer to citizens as 'Indigenous Peoples', nearly all people living in the Project area meet the IFC PS7 criteria for being Indigenous Peoples and all communities meet the characteristics of Indigenous communities. Therefore, this section includes reference to the Project's assessment of its potential impacts on Indigenous Peoples', livelihoods, and cultural heritage that are also covered elsewhere across this ESHIA Synthesis; as mentioned previously, a separate document is addressing human rights.

The assessment considered baseline customary land and marine tenure, cultural identity, and resource dependence within the PAoI, evaluated potential positive and negative impacts during construction and operations, and identified mitigation measures designed to safeguard Indigenous rights and wellbeing.

The approach was informed by IFC PS7 (Indigenous Peoples) and builds on commitments established in the EIS (2019) and the ICP/FPIC Implementation Plan (2025), with particular attention to FPIC, customary governance, land access, and the specific vulnerabilities of river-dependent and coastal communities. Impact pathways and analysis of potential and residual impacts relevant to Indigenous Peoples are also covered across the other sections of this ESHIA Synthesis.

6.20.2 Baseline

Indigenous Status and Overall Context

Although the government of PNG does not refer to the population as "Indigenous", in this ESHIA Synthesis (and the associated Project documents from which it was derived) all clans and communities of the PAoI are considered Indigenous Peoples whose land, identity, culture and livelihoods are tightly connected to customary land-ownership and clan structures, extensive use of natural resources, riverine environments, and culturally and spiritually significant sites. It is worth noting that this definition/qualification would apply to a large swath of the Papua New Guinean population. The Project operates in a highly Indigenous context where IFC PS7 applies, and where land and livelihood risks are closely interlinked with PS5 (land acquisition and involuntary resettlement/economic displacement), PS6 (ecosystem services) and PS8 (cultural heritage).

Across the PAoI, communities range from small, dispersed riverine hamlets and villages associated with the PRL-15 upstream area and Purari tributaries, to more densely settled coastal settlements at Oroko Bay. In PRL-15 and along the Purari system, settlements are typically remote and access is strongly river-dependent, with livelihoods grounded in gardens, sago, fishing, hunting and forest resources. At Oroko Bay, shoreline villages are more concentrated in a narrow coastal strip, with daily life and livelihoods closely tied to nearshore and estuarine fisheries, coastal gardens, mangroves and beach/dune resources, alongside longstanding cultural landscapes connected to coastal travel and exchange networks.

Customary tenure is dense and overlapping. Multiple clans share and negotiate use of land along the PER, riverbanks and waterways, forest resources, and sago and fishing zones. Social mapping for the onshore PER identifies many clans with land interests in the broader corridor and a smaller subset with direct interests along the core PER RoW and buffer, while interlinked clans along the Purari River are affected by river-based activities. See below Figure 6-43 for the proposed licenses with clan boundaries.

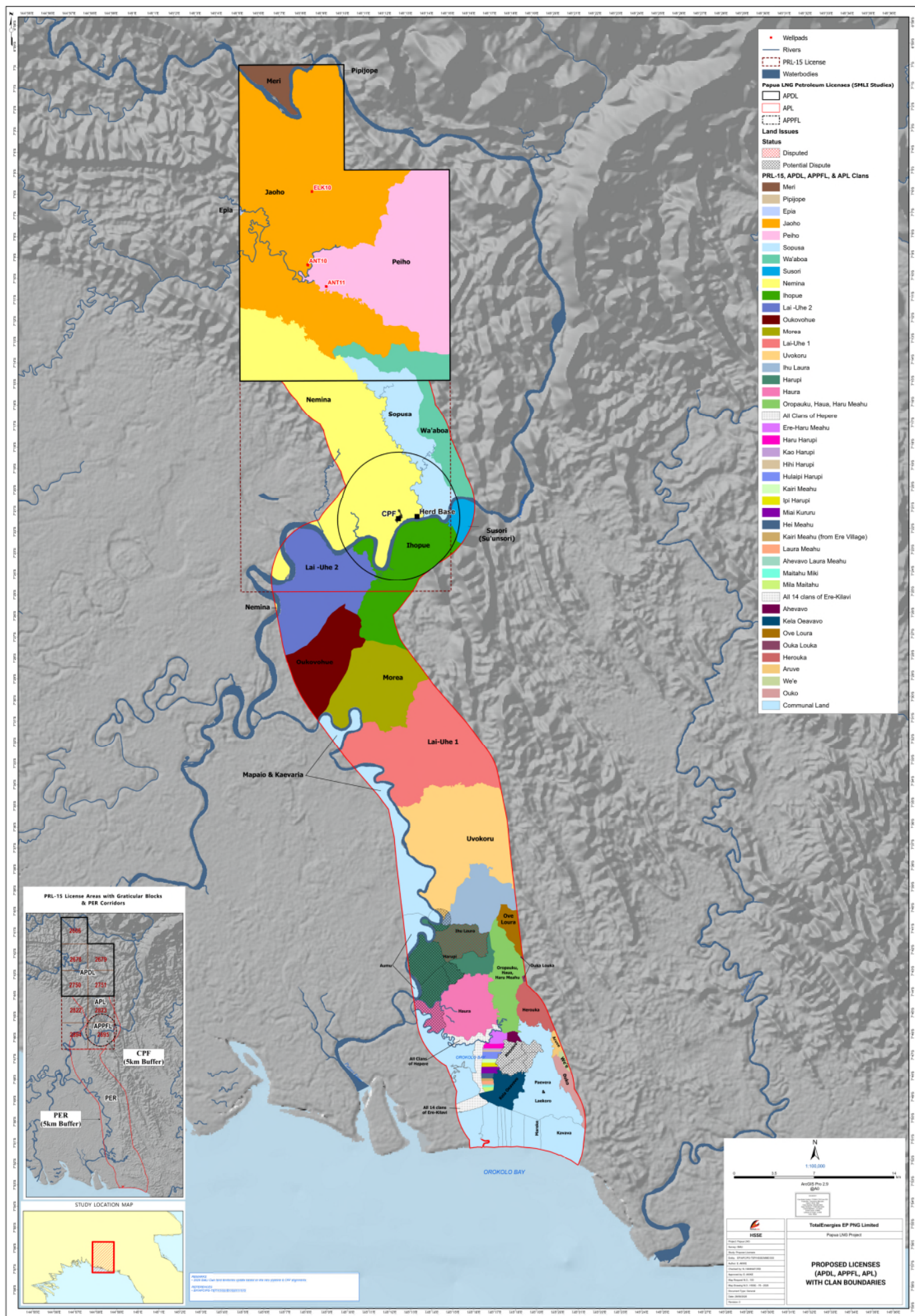


Figure 6-43: Proposed Licenses with Clan Boundaries (Source: TEP PNG, 2026)

For the purposes of the ESHIA Synthesis, Indigenous Peoples baseline conditions and potential impact pathways are described using the Project area framework applied across the social sections of this report. This provides a consistent spatial basis for considering potential effects on Indigenous Peoples' customary land and water areas, livelihood resources, cultural heritage, engagement requirements, and mitigation. References to the LALDPs are treated as land access and livelihood planning instruments, rather than as separate baseline or impact-assessment segments.

The **PRL-15** upstream area is owned and used by Pawaia and, in some locations, Kaura clans whose gardens, hunting areas, forest-product collection areas, waterways and cultural sites extend across or near the wellpads, gathering lines, CPF and associated access/logistics areas.

In the **northern part of the onshore PER**, including the Evara area, the pipeline right of way, access tracks and associated work areas pass through customary land used by Indigenous clans for gardens, sago, hunting, forest-product collection and movement between settlements and resource areas. SMLI work indicates overlapping land interests and the potential for multiple clan or lineage claims within and near the corridor.

In the **middle part of the onshore PER**, within the Muro area, the onshore PER crosses a complex customary tenure landscape involving Kaura, Orokolo/Muro and other landholding groups. The right of way and associated access requirements may intersect gardens, sago areas, forest resources, fishing places, clan boundaries and cultural heritage locations.

In the **southern part of the onshore PER**, at Orokolo Bay and along the Orokolo Coast, the coastal landfall and associated onshore works overlap with shoreline settlements, including Harevavo, Marea, Larihairu, Kaivu, Kovu, Huruta and Iuku. These communities have strong cultural, livelihood and historical connections to the coastal landscape, including beaches, dunes, mangroves, nearshore fisheries, gardens, burial places and Hiri-linked cultural landscapes.

Along the **Purari River transport corridor** and associated waterways, riverine communities, including Kaura, Jare and related Purari clans, depend strongly on the river system and its tributaries for fishing, sago processing, drinking water, transport & access to health schools, healthcare and markets; and cultural practices. River channels, banks, floodplain areas and landing points are therefore central to both livelihoods and customary tenure arrangements. These communities will be exposed to planned project activities including dredging, barging, and ferry traffic.

Within the **offshore export pipeline routes**, marine territories associated with Orokolo and wider Toaripi coastal areas extend across reefs, channels and offshore fishing grounds in the Gulf of Papua. These areas support small-scale fisheries, customary marine resource use and travel routes between coastal communities.

Growth Centres, including Wabo, Baimuru, Ihu, Kikori and Kerema, not directly in the footprint of project activity but are considered as indirect social change areas. In these locations, migrants, local landowning clans, service providers and host communities may interact as population and economic activity increase. Access to land in these locations is often negotiated through customary arrangements with local landholding groups, creating fluid and sometimes contested patterns of settlement expansion.

Cultural Heritage, FPIC, and Indigenous Governance

Cultural heritage areas (including specific riverbank sites, sago zones, settlement areas and sacred landscapes, identified through consultation with communities) are deeply tied to Indigenous identity. Cultural heritage sites have been confirmed in the CPF area and other areas covered by the cultural heritage PCS reports.

Indigenous governance and decision-making are typically channelled through clan chiefs and elders, supported by church leaders and men's and women's groups, with consultation and negotiation structured

around customary authority and kinship networks. Youth participation in decision making occurs less consistently under local governance processes.

Project activities may trigger FPIC in accordance with applicable PS where adverse impact on affected communities can be expected and/or where the activities may significantly impact on critical cultural heritage. The IPF (2026) and ICP/FPIC Implementation Plan (2025) establish a five-phase model covering awareness and information disclosure, internal deliberation, negotiation, decision-making/documenting consent, and implementation monitoring.

The process is moving forward through targeted clan and community engagement, field-based sensitisation, verification of representatives, independent legal advocacy and documentation of outcomes. It also recognises that communities require sufficient time for customary deliberation and that engagement may need to be repeated where Project design, footprint, schedule or impact pathways change.

Field engagement indicates a strong level of community awareness regarding consultation processes including FPIC, Project impacts, mitigation measures and compensation arrangements. Where applicable, FPIC outcomes are documented and incorporated into relevant Project management processes, including land access, compensation, cultural heritage management, grievance management and the LALDPs. This approach supports the implementation and monitoring of agreed commitments over time.

Existing Vulnerabilities

Communities in the Project area face systemic vulnerability due to geographic remoteness, limited access to health, markets and education services, strong reliance on ecosystem services, exposure to community health and safety risks, and growing pressures from in-migration into river, coastal and town-edge communities. Given the connection to customary land, river and marine resources, economic displacement risks arise wherever land access or Project activities leads to loss of gardens and plantations, fishing grounds, sago areas, forest products, or medicinal plants, including where access restrictions or safety zones constrain customary use rather than permanently removing land. These material losses can trigger cultural and spiritual impacts, especially in the Purari system and coastal zones where livelihoods, identity and sacred sites are collocated.

Receptor list:

- Indigenous communities (by clan/group)
- Customary institutions such as indigenous governance and decision-making bodies
- Women/elders/youth within those groups,

6.20.3 Impact Assessment

Findings by Project Area

PRL 15

In the PRL-15 upstream area, potential impacts on Indigenous Peoples are driven primarily by Project land access and construction activities.

Project activities may temporarily restrict or alter access to customary land and resource-use areas and may aggravate unresolved concerns linked to previous exploration-phase agreements if land access, compensation and benefit-sharing processes are not managed transparently.

Consistent with the Project's IPF, FPIC, stakeholder engagement and land access commitments, the Project's engagement activities will continue to support inclusive clan participation beyond formal leadership structures. Land, governance, livelihood and cultural heritage-related receptors in PRL-15 can be sensitive to impacts, depending on the location and how avoidable impacts are to identified sites.

Purari River Transport Corridor and Associated Waterways

For riverine communities along the Purari River and associated waterways, potential impacts are closely linked to the river's role as a livelihood, transport, cultural and spiritual resource.

Dredging, barging, navigation aids, vessel movements, aggregate sourcing and other river-based construction activities may affect Indigenous Peoples. Community concerns include potential effects on fish and aquatic resources, sago and garden areas connected to swamp-river systems, vessel-wake and collision risks for small craft, and temporary disruption to river access during active works.

These effects may translate into reduced fishing productivity, increased travel time or cost, altered access to services and markets, and pressure on river-centred cultural practices. Given the centrality of the Purari River system to livelihood security, identity and customary tenure, receptors in the river transport corridor and associated waterways can be sensitive to potential impacts, particularly during construction.

Onshore PER North Segment: Evara Area

Potential impacts include temporary or permanent loss of access to land and livelihood resources, disturbance to culturally important places, and increased risk of intra- or inter-clan tension if land access, compensation and participation arrangements are not verified and communicated transparently. Customary tenure, livelihood access and governance are therefore sensitive to potential Project impacts.

Onshore PER Mid Segment: Muro Area

Within the Muro area, the onshore PER crosses a complex customary tenure landscape involving Kaura, Orokolo/Muro and other landholding groups.

The main Indigenous Peoples risks relate to disruption of access to productive land and resources, perceived inequity in compensation or employment opportunities, and the potential for existing land or lineage disputes to be intensified by Project-related payments or agreements. Given the density of overlapping claims and the importance of the corridor to local livelihoods and identity, Indigenous peoples in the area are considered sensitive to Project Impacts.

Onshore PER Southern Segment: Orokolo Coast

Project activities may temporarily affect access to the beach, nearshore fishing areas, coastal gardens, mangrove resources and customary movement routes. The concentration of coastal infrastructure, limited availability of alternative land and high dependence on nearshore and coastal resources mean that impacts may be spatially concentrated and multi-dimensional, affecting livelihoods, cultural heritage, social cohesion and customary tenure.

The area is culturally sensitive due to recorded burial areas, sacred natural features and intangible cultural heritage values identified through Cultural Heritage Pre-Clearance Surveys and community consultation.

Offshore Export Pipeline Routes

During offshore construction, temporary marine safety controls will be required around construction vessels and pipelay activities. These controls are expected to move progressively with the construction spread, allowing customary fishing and navigation to continue in surrounding areas outside the immediate active work area. Once offshore pipeline installation is complete, no permanent community exclusion zones are anticipated for the offshore pipelines, and routine access to marine areas is expected to continue subject to standard maritime safety requirements.

Potential impacts are therefore expected to be temporary and localised, but receptors may remain sensitive where offshore works overlap with important fishing grounds, travel routes or customary marine areas.

Growth Centres

In these locations, potential impacts on Indigenous Peoples are related to in-migration, speculative land transactions, rising rents and land prices, pressure on informal settlements, increased demand for services, and changing relationships between customary landowners, tenants, migrants, businesses and service providers.

These processes may weaken customary control over peri-urban land, increase pressure on poorer Indigenous households, including tenants and non-landowning relatives, and create new disputes as cash, employment expectations and outside actors enter local land and housing markets.

Given the limited service capacity in these locations, reliance on customary governance and ecosystem resources, and potential for rapid Project-induced social change, Growth Centres are treated as socially sensitive areas requiring enhanced engagement, monitoring and mitigation.

6.20.4 Mitigation

Mitigation for Indigenous Peoples is organised under the IPF and implemented through the Project's ICP/FPIC process, land access and compensation procedures, cultural heritage management, grievance management, and the LALDPs. Building on the agreed five-phase FPIC model, this framework provides the Project-wide basis for consultation, consent, land and water access, livelihood restoration, cultural heritage safeguards, benefit-sharing and monitoring. FPIC is required where Project activities may trigger FPIC in accordance with applicable IFC PS, including where adverse impacts on affected communities can be expected and/or where the activities may significantly impact on critical cultural heritage, and must be revisited through the Management of Change process where design changes or new activities could create material adverse effects.

The LALDPs are a core mitigation pathway for Indigenous Peoples because they translate land and resource access commitments into livelihood restoration and development measures. LALDP North covers PRL-15, the northern Purari River extents within the PAoI, Hou Creek, CPF, Herd Base and the airstrip. LALDP South covers waterway communities, Orokolo Bay and the export pipeline corridor. Programme domains include agriculture, food security and nutrition; fisheries, river and coastal livelihoods; micro-credit and community funding support; and education, workforce participation and capacity building. These domains are intended to restore or improve livelihood outcomes and to support culturally appropriate, locally relevant development benefits for affected clans and communities.

To improve the robustness of FPIC outcomes, the Project has strengthened facilitation capacity, documentation and quality assurance. Measures include independent legal advocacy for clans during negotiations, accessible disclosure of Project impacts and mitigation measures, separate or targeted engagement with women and vulnerable groups, tracking of FPIC evidence by phase and by clan/community, and quality checks before agreement signature to confirm that information has been disclosed, representation has been verified, internal deliberation time has been respected, and concerns have been recorded and addressed. FPIC implementation will continue to be monitored through engagement records, signed MOUs, land access and compensation agreements, grievance records, LALDP monitoring and periodic review with affected communities.

A Vulnerability Assessment has been completed for Indigenous groups across the relevant project areas, with particular focus on highly exposed groups including Pawaian communities, Ne'ea Creek Fish Camp, Purari river-dependent villages, shoreline communities at Orokolo Bay and waterways communities affected by dredging, barging and ferry traffic. The Project will implement the LALDPs and ongoing engagement measures as core mitigation commitments to address temporary access constraints and support customary fishing and resource use. Effectiveness will be monitored under the CHMP and ESMP to ensure appropriate outcomes for affected communities.

Mitigations relevant to Indigenous Peoples are covered across this ESHIA Synthesis. Mitigations that *are additional to* those already listed under other relevant sections are listed in Table 6-70.

Table 6-70: Mitigation measures - Indigenous peoples

Impact	Mitigation code (As in MP)	Description	Source document
Impacts to governance	SM020	Develop and implement targeted engagement activities with women in the PACs to help build their knowledge of the Project so that their views and rights are considered throughout its ongoing development.	<i>EIS/ Upstream CESMP; 2019</i>
	SM021	The Project will work with traditional leaders and ward councillors to encourage community volunteers to participate in the Project's social monitoring and evaluation.	<i>EIS/ Upstream CESMP; 2019</i>
Decline in customary social systems and law and order	SM022	In areas at high risk of Project-induced in-migration in the PAoI, undertake a feasibility assessment in consultation with relevant stakeholders on initiatives to encourage regulation and monitoring of in-migration.	<i>EIS/ Upstream CESMP; 2019</i>
	SM023	The Project will establish governance arrangements for the implementation and monitoring of community investment and development programs	<i>EIS/ Upstream CESMP; 2019</i>
	SM024	Support sustainable initiatives to strengthen village law and order organisations (e.g., village courts, local police and churches)	<i>EIS/ Upstream CESMP; 2019</i>

6.20.5 Residual Impacts

Core residual impacts are summarised here for completeness. Following implementation of the mitigation measures described in Section 6.20.5, and other relevant sections of this ESHIA, residual impacts on Indigenous Peoples are expected to remain localised and primarily associated with land access restrictions and changes in resource use patterns within certain corridor segments. These impacts arise where Project infrastructure, access controls or safety zones permanently restrict access to customary land or natural resources.

- **Land, Territories and Resource Access:** Economic displacement residual impacts will include reduced or lost access to a small proportion of Clan customary land, gardens, sago areas, forest resources and medicinal plants in all segments, particularly where land access or restricted access to key hunting, gardening or forest-product areas. Residual economic displacement may occur for some households or clans where gardens, fishing areas, sago stands or forest-product areas are affected, particularly where replacement land of comparable livelihood and cultural value is limited or fragmented, and where overlapping customary claims remain unresolved. For further detail, see Section 6.15.
- **Riverine and Coastal Systems:** For highly river-dependent Purari and waterways communities, dredging, barging and aggregate sourcing may result in residual effects that cannot be fully offset, including localised changes in river morphology, bank stability and navigation routes. In addition, there will be temporary disruption of access to fishing and sago processing areas. Possible changes in fish abundance and composition as a result of project activities is a concern raised by communities. For coastal Indigenous communities, marine activity (offshore pipeline installation and vessel traffic) may impact nearshore fisheries and beach systems that underpin food security and identity. For further detail, see Section 6.15.
- **Cultural Landscapes and Intangible Heritage:** Through the application of the CHMP, including CH PCS and specialist oversight during ground disturbance, known cultural heritage sites within construction footprints will be identified, recorded and, where feasible, avoided or managed through agreed treatment measures. There remains an ongoing possibility that previously undocumented or intangible cultural values associated with rivers, dunes and nearshore seascapes may be affected indirectly through temporary changes in access, activity patterns, noise/light intrusion or altered landscape setting. For further details, see Section 6.21.
- **Institutions, FPIC, and Grievances:** Over time, there is a residual risk that customary governance may erode or become distorted potentially marginalising women, youth, and non-land-owning households. Complex overlapping territories mean that some disputes over land boundaries, clan inclusion or exclusion, and benefit-sharing could persist or recur. There is also a residual risk that some cultural heritage losses and perceived infringements on Indigenous decision-making rights may be viewed as non-compensable, leading to ongoing grievances or calls for renegotiation. See Section 6.15, 6.21 and Table 6-71 below for details on residual impacts that cover institutions, FPIC and Grievances.

The impact pathways and analysis of potential and residual impacts relevant to Indigenous Peoples are covered across this ESHIA Synthesis. As such, the table below features only those residual impacts *that are additional* to those already listed under other relevant sections.

Table 6-71: Summary of potential residual impacts - Indigenous peoples (Source: EIS Social Impacts, 2019)

Key Sensitivity/ Receptor	Main Activity	Potential Impact	Direct / Indirect / Induced	Location of Activity/Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
Governance and leadership structures.	Project employment and procurement	Challenges to traditional leadership and community governance.	Indirect	Traditional leaders, PAPs, PACs and local communities in and around PRL-15, around the export pipeline route.	C, O, D	SM020 SM021	Medium / Low	Minor
Customary social systems	Project employment and procurement	Decline in Customary Social Systems.	Induced	Traditional leadership, PAPs ,PACs and local communities in and around PRL-15, around the export pipeline route, and along the river transport corridor.	C, O	SM022 SM023 SM024	Medium/ Low	Minor
Community relations	Project induced-in-migration	An increase in disputes due to competition over natural resources.	Induced	PAPs, PACs and local communities in and around PRL-15, around the export pipeline route, and along the river transport corridor.	C	SM022 SM023 See also mitigations relevant to ecosystem services and livelihoods in Section 6. 16 and 6.19	Medium/ Low	Minor

Notes: C = construction, O = operations, D = decommissioning

6.21 Cultural Heritage

6.21.1 Introduction

This section synthesises the methodology and findings documented in the Project's existing source assessments and management plans relating to cultural heritage. It does not introduce new impact ratings, residual impact conclusions, or independent analysis beyond the source material.

CH in the PAol is inseparable from Indigenous Peoples' identity, customary land, river and marine tenure, livelihoods, and spiritual practices, as described in the previous section.

Accordingly, the CH assessments undertaken to date build on the Project's Indigenous baseline, the named project-area framework described in Section 2.3.3, and FPIC commitments, while focusing specifically on the identification, evaluation, and management of tangible, intangible, and potential critical cultural heritage.

The Project has already experienced limited impacts on tangible CH in areas where sites were identified through PCSs and salvage undertaken in advance of ground disturbance. With the implementation of the CHMP, no further direct impacts are anticipated, however, the potential for chance finds or newly identified sites remains, and any such discoveries will be managed through the Chance Finds Procedure and, where required, additional salvage or culturally appropriate treatment measures.

6.21.2 Baseline

Project Context and Traversed Cultural Landscapes

CH within the PAol is expressed not only through discrete physical sites, but through broader Indigenous cultural landscapes that link people, place, and customary practice. Rivers, wetlands, dunes, reefs, and settlement areas are imbued with cultural and spiritual meaning, forming part of living heritage systems that underpin identity, tenure, livelihoods, and ritual life. Accordingly, the significance of CH in the PAol lies in the interconnected relationship between natural features and community cultural values, where landscapes function as repositories of oral history, ancestral presence, and ongoing customary use rather than isolated archaeological locations.

Significance is particularly high for:

- **Purari River communities:** Riverbanks, confluences, eddies, sandbars, and back-swamps hold, burials, spirit places, and ritual bathing zones closely integrated with river-dependent livelihoods.
- **Orokolo Bay coastal communities:** Dune ridges, beach fronts, mangroves, and nearshore waters contain burial grounds, mission sites, and Hiri-era ceremonial landscapes. Nearshore waters in Orokolo Bay form part of a living cultural seascape governed by strongly held beliefs in spirit custodians. Communities describe the coastal waters as divided into several spiritual sections (approximately four to six), each associated with specific spirits, and customary chants or songs continue to be performed when travelling or fishing in these areas. Similar spirit-based custodianship and protocols apply along major rivers and waterways, where particular bends, eddies, confluences, and bathing places are recognised as culturally and spiritually significant.
- **PRL-15 clans:** Wetlands, creeks, and forested ridges near the CPF carry spirit-site complexes and former settlement locations.

Other CH sites of importance in the PAol include those associated with PRL-15 spirit wetlands; the Heve spirit-site complex; ancestral Popo village; and the Caution Bay archaeological complex (Lapita and post-

Lapita sequences identified by PNG LNG, which demonstrate the high archaeological potential of the wider Gulf of Papua seaboard).

Heritage Types and Significance

The following categories summarise the principal types of tangible and intangible CH values identified or expected within the PAol, based on SMLI, PCSs, and consultations, and are presented to frame the receptors considered in the Project's assessments to date:

- **Tangible CH recorded in the PAol:** Includes clan and mission cemeteries; ancestral villages; spirit sites at wetlands, hilltops, eddies, and confluences; mission stations and churches; carved posts and ritual structures; and archaeological deposits.
- **Intangible CH recorded in the PAol:** Includes sacred riverscapes and seascapes; totems and spirit-beings; story-places; oral histories of migrations and warfare; and ritual practices linked to sago, gardens, fishing, healing, and initiation.

See Figure 6-44, Figure 6-45 and Figure 6-46 below for some examples of cultural heritage recorded within the PAol.



Figure 6-44 Subuia Spirit Site (Subu, Ura villages (Photo: Source: EIS, 2019)



Figure 6-45: Ceremonial and Spirit Tree (Oral tradition site) (Source: EIS Addendum, 2024)



Figure 6-46: Traditional dress and dancing (Kaevaria) (Source: EIS Upstream Cultural Heritage and Archeology baseline Report, 2017)

Existing Data and Evidence Base

The evidence base for CH is strongest in:

- PRL-15 and Orokolo Bay (multiple CH PCSs, salvage excavations, and participatory clan mapping)
- Caution Bay / LNG Plant area (PNG LNG's intensive rescue archaeology); and Purari River through the CH River Surveys (2024).

Coverage is moderate along the onshore PER and offshore pipeline corridor (desktop synthesis, targeted surveys, participatory mapping), and patchy for certain riverine and areas at risk of in-migration, where micro-sites (small graves, bathing sites, minor dunes) remain under-documented. The Project updates the CHMP and consolidated CH GIS/database as it records new sites.

Receptor list:

- Tangible heritage custodians (sites, graves, artefacts)
- Intangible heritage holders (rituals, sacred knowledge)
- Community cultural leaders
- National/provincial heritage authorities.

6.21.3 Impact Assessment

The CH assessment applies the named project-area framework used for land, livelihoods, displacement and Indigenous Peoples, while applying an IFC PS8 lens. PRL-15, Onshore PER Northern Segment - Evava Area, Onshore PER Mid Segment - Muro Area, Onshore PER Southern Segment - Orokolo Coast, offshore PER/customary fishing zones, waterways/river transport corridors and Growth Centres each have distinct Indigenous groups, land-use patterns, and heritage profiles.

- **Data Sources:** SMLI clan listings; dedicated cultural heritage baseline and CHMP; EIS (2019) and EIS Addendum (2024) CH sections; D&B ESIA (2025); Cultural Heritage Assessment (CulHA) summary; and findings from multiple CH PCSs undertaken across PRL-15, the CPF area, the onshore pipeline corridor, and Orokolo Bay. These sources are complemented by PIIM assessments, results of ICP and FPIC processes, and the HRIA. Desktop and GIS Screening: Analysts reviewed existing SMLI, ethnography, mission records, and historic mapping to identify high-potential valued cultural areas (VCAs): ancestral villages, cemeteries, dunes, wetlands, mission sites, eddies, river confluences, and likely archaeological deposits.
- **Participatory CH Studies:** Clan-based consultations and CH walk-throughs (including women-only sessions) mapped sensitive sites, former settlements, and story-places by VCA, linking tangible features to intangible narratives and practices.
- **Field Surveys and Salvage:** CH survey teams applied standardised recording, test-pitting, and salvage methods in priority VCAs, under National Museum and Art Gallery (NMAG) issued permits. These findings are based on CH PCS undertaken in advance of ground disturbance, and form part of the primary evidence base used to classify cultural heritage sensitivities and potential impacts.
- **Chance Finds and CH Survey & Salvage Procedures** are in place for any previously unknown sites encountered during construction.
- **Performance Standard/Rights-Based Screening:** The assessment screened impacts for potential effects on tangible, intangible, and critical CH, covering direct physical disturbance and indirect effects (landscape setting, access, ritual use, cumulative perception).

- **Impact Classification:** CH receptors were screened and categorised as (i) general heritage values, (ii) high-significance heritage (sites or landscapes of high sensitivity due to sacredness, irreplaceability, or strong identity linkage), or (iii) potential critical cultural heritage (e.g., major spirit-site complexes, dune cemeteries, and ancestral village areas). The assessment applies an avoidance-first hierarchy, with impact evaluation focused on locations where complete avoidance is not feasible due to the fixed nature of Project infrastructure or safety constraints, and where residual risks require strengthened mitigation and consultation.

Findings by Project Area

PRL-15

CH sensitivity is high in the PRL-15 uplands and wetlands, where spirit wetlands, creek-junction sites, and forest spirit places associated with Kaura, Iare and Pawaia clans overlap with parts of the wider field development area and CPF catchment. While Project design updates, including CPF relocation, have sought to reduce disturbance and avoid identified high-significance areas where feasible, CH PCS have not yet been completed across all locations within this segment. Accordingly, there remains a residual risk that additional high-significance tangible or intangible heritage features may be identified as further surveys and ground-disturbance planning progress. Where such areas are confirmed and complete avoidance or redesign is not possible or practicable, the Project will engage in consultation with the relevant clan(s) to agree culturally appropriate measures, which may include access controls, ritual clearance, salvage, relocation by agreement, or other forms of community-endorsed treatment.

Onshore PER Northern Segment – Evara Area and Onshore PER Mid Segment – Muro Area

The onshore PER crosses a dense mosaic of clan territories with widespread, if not always visible, heritage: clan cemeteries near hamlets and churches, small grave groups in fallow gardens, spirit trees and stones, and former settlements now under secondary forest. Pipeline RoW and access tracks mainly affect these dispersed sites rather than large complexes. The principal CH risks are the disturbance of smaller, undocumented sites that are not identified during CH PCSs and the fragmentation of cultural landscapes where access to ritual areas is constrained. In areas of clan overlap or land dispute, CH impacts can also trigger intra-community tension where graves or sacred sites are associated with contested histories.

Onshore PER Southern Segment – Orokolo Coast

Orokolo Bay is one of the most culturally sensitive segments. Dune ridges hold extensive burial grounds; mission and church compounds overlay earlier village sites; and the shoreline and dunes are integral to Hiri-era exchange and ritual and cultural narratives. Project landfall and any coastal road improvements, if mis-sited, could intersect or expose dune cemeteries, high-potential archaeological deposits, and ceremonial grounds. Coastal erosion and sea-level change are already affecting graves and mission structures. Project works may interact with these dynamics by altering beach access, drainage, or localised erosion, even where main cemeteries are avoided.

Offshore PER / Customary Fishing Zones

The offshore corridor passes through a “seascape heritage” setting where reefs, channels, shoals, and fishing grounds are named and imbued with spiritual meaning and clan histories. Underwater archaeological potential exists for isolated wrecks or submerged sites, particularly near historical navigation routes. While the physical footprint of the pipeline and anchors is relatively narrow, seabed intervention could disturb currently unidentified sites. Intangible heritage impacts relate to perceptions that sacred reefs or totem grounds are being crossed or enclosed by exclusion zones and that cumulative offshore activity is changing the spiritual character of the seascape.

Waterways / River Transport Corridors

Along the Purari, riverine cultural landscapes are intensely layered; burials, former villages, clan landings, ritual bathing points, and taboo reaches occur on banks, bars, eddies, and confluences. Dredging, turning basins, bank works, and aggregate sourcing may disturb riverbank cemeteries, erode settlement–burial complexes, and alter the physical character of sacred bends and sandbars. Potential impacts from Project activity, changes in access patterns, and perceived river “health” may alter the cultural landscape and its associated practices.

Growth Centres

In potential growth areas, CH includes urban and peri-urban cemeteries, historic churches and mission compounds, and contemporary ritual/meeting spaces. PIIM and associated town expansion may bring unplanned encroachment on these sites, especially where formal planning and CH inventories are weak. Project facilities, contractor camps, and associated road improvements can aggravate these pressures if not sited with cultural constraints in mind. Over time, the combined effects of town growth and changing social norms may weaken customary authority over CH and marginalise ritual practices.

6.21.4 Mitigation

The Project is consolidating CH management under a unified CHMP linked to the LALDPs and the ICP/FPIC process.

- **Avoidance First:** The Project applies avoidance as the primary response for critical and high-significance CH sites. Where such sites are identified, avoidance measures (e.g., route optimisation, setbacks, and no-go zones) are developed and confirmed through consultation with the relevant clan custodians. Avoidance of high-significance heritage is not determined solely through technical screening; it requires discussion with clan custodians to confirm cultural significance, agree boundaries and access conditions, and ensure culturally appropriate treatment of sensitive areas.
- **Survey and Salvage:** Full-coverage CH surveys are undertaken ahead of new ground disturbance in each Project Area, applying NMAG-approved methods and, where unavoidable, targeted salvage excavations and agreed ritual clearance/reburial. Salvage has already been successfully undertaken in advance of works in areas where tangible heritage sites were identified, and the same procedures will apply should additional sites be encountered. Salvage activities are undertaken under permits issued by NMAG. Recovered archaeological materials are recorded, catalogued and handled in accordance with NMAG requirements. Custody and final disposition of artefacts are determined in consultation with NMAG and, where relevant, customary custodians. In the case of human remains or culturally sensitive materials, treatment (including reburial or culturally appropriate handling) is agreed with affected clans and documented under the CHMP.
- **Chance Finds Procedures:** Onshore and offshore Chance Finds Procedures include stop-work, notification, securement, assessment, and community consultation steps, supported by contractor inductions and the presence of Company CH officers onsite during ground disturbance activities to ensure procedures are applied effectively.
- **Indigenous Participation and FPIC:** Indigenous elders, women’s groups, and increasingly youth participate in CH mapping, survey design, salvage decisions, and the treatment of graves and spirit sites.
- **Intangible Heritage Support:** The Project will support the documentation, transmission, and practice of intangible heritage (recordings, rituals, cultural education) where communities seek assistance and will monitor intangible CH.

- **Data and Reporting:** A consolidated CH GIS/database tracks sites, surveys, mitigation actions, and Chance Finds. The Project provides Project Area cultural heritage updates in community briefings and external reporting, maintaining appropriate confidentiality.

Table 6-72 presents the relevant mitigation measures in relation to CH.

Table 6-72: Mitigation measures - Cultural heritage

Impact	Mitigation code (As in MP)	Description	Source document
Potential direct and/or indirect disturbance, loss of access, loss or damage to cultural heritage sites	CHM001	Develop and implement archaeological clearance procedures related to all early works and construction activities. This will include: - Establishment of a buffer area around identified sensitive sites near the planned project facilities, prior to early works and construction activities, to avoid accidental or inadvertent impacts. - Management of potential direct impact to any known site where impact is unavoidable, in consultation with local affected communities. - A Chance Finds Procedure for managing the discovery of ancestral remains, burial sites, and human remains. - Other measures, e.g. on site-specific recording, marking, erosion prevention, relocation, clearance distances and monitoring.	<i>EIS/ Upstream CESMP; 2019</i>
	CHM003	Maintain traditional access to significant cultural places through consultation with relevant communities.	<i>EIS/ Upstream CESMP; 2019</i>
	CHM004	Appoint a Project Cultural Heritage Officer during the construction phase to oversee the implementation of the Chance Finds Procedure, to conduct training as appropriate and to act as key contact for Project workers and contractors on all matters related to cultural heritage.	<i>EIS/ Upstream CESMP; 2019</i>
	EM001	All sites proposed for development as part of the Project will be subject to a preconstruction survey to clearly identify acid sulphate soils, sensitive sites and habitats, e.g. roosting, breeding, nesting and threatened species sites, priority ecosystem services, archaeological sites, burial sites, sites of religious importance to be subject to specific mitigation measures.	<i>EIS/ Upstream CESMP; 2019</i>
	EM028	All Project personnel, workers, contractors and 3rd party operators will be educated during inductions and safety training about: - Fire risks, including the heightened risk during extreme drought years and smoking. - Wildlife values. - Weed, pathogen and animal pest hygiene and control measures. - Identification of cultural heritage, cultural heritage awareness, measures for avoiding impacts and the Chance Finds Procedure.	<i>EIS/ Upstream CESMP; 2019</i>
	CHM005	Develop intangible cultural heritage workshops in collaboration with relevant PACs, with guidance and oversight provided by cultural heritage specialists.	<i>EIS/ Upstream CESMP; 2019</i>
	CHM002	Develop and enforce the Project Material Culture Policy that prohibits members of the Project workforce from obtaining items of material culture from local communities through purchase or by way of a gratuity.	<i>EIS/ Upstream CESMP; 2019</i>

6.21.5 Residual Impacts

Residual impacts remain mostly Minor to Moderate for CH receptors due to the sensitivity and irreplaceability of these features. Even where mitigation measures (e.g. avoidance, salvage, and setbacks) are applied, the Project may result in residual CH impacts due to:

- **Access and setting changes:** In some locations, infrastructure footprints and safety buffers may reduce access to heritage-rich landscapes (e.g., riverbanks, sago areas, dunes, reefs) and may alter their setting (noise, lighting, visual change), even where known sites are avoided.
- **Dynamic riverine/coastal environments:** Riverine and coastal processes (e.g., erosion and morphology) may change how cultural landscapes are used and perceived over time, thereby affecting place-based cultural values. Potential temporary changes to sand bank morphology at Purivo junction as a result of Purari River dredging remains the only Major residual impact.
- **Intangible heritage and continuity:** Some cultural practices, particularly oral traditions, are tied to specific places and mobility patterns may be affected if access, safety, or environmental conditions change. The potential decline in use of local languages also in favour of Tok Pisin also remains Moderate impact due to Tok Pisin being the favourable language for Project employment and procurement; mitigation focuses on maintaining access where safe, culturally appropriate engagement, and adaptive management.

There may also be potential for future unrecorded heritage discoveries. CH PCS coverage is not yet complete across all planned disturbance areas. Accordingly, there remains an ongoing possibility that additional cultural heritage features—including small, ephemeral, or previously undocumented sites—may be encountered as ground disturbance progresses. This risk will be managed in accordance with the CHMP and Chance Finds Procedure, including immediate stop-work measures, notification, specialist assessment, consultation with customary custodians, and culturally appropriate agreed treatment (with avoidance as the preferred outcome, and salvage or other measures applied where avoidance is not feasible).

Table 6-73 presents residual impacts in relation to cultural heritage.

Table 6-73: Summary of potential residual impacts - Cultural heritage (Source(s): EIS Impacts Cultural Heritage (2019); EIS Addendum (2024); FEED Changes EAR (2025); Hou Creek Aggregate Dredging EAR (2025); D&B ESIA (2025))

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
Tangible Cultural Heritage								
Archaeological (surface or subsurface scatters)	Earthworks, vegetation clearance, logistics and transport	Potential direct disturbance, loss, damage to cultural heritage sites.	Direct	Road R03	C, O	CHM001 CHM002 CHM003 CHM004 EM001 EM028 Salvage (undertaken)	High/Medium	Moderate
Archaeological (isolated surface artefact)			Direct	Export pipeline route (2 receptors, 1 of them†)	C, O	See Above	High/Medium	Moderate
River transport corridor Vaili Vaivere, Akia Ini Laua complex, Mairi Vaara, Old Iare, Alau Kaipu, Ava Euao	Logistics and transport – barges	Potential disturbance, loss, damage or restricted/changed access to identified or unidentified tangible cultural heritage sites.	Direct	River transport corridor PACs	C, O	CHM001 CHM002 CHM003 CHM004 EM001	Medium / Negligible	Negligible
Orokolo Bay culturally sensitive area sites and Maiaro ancestral village	Earthworks, vegetation clearance		Direct	Export pipeline route PACs	C, O	EM028	High / Low	Moderate
Old watercourse	Dredging	Potential direct and/or indirect disturbance, loss of access, loss or damage to cultural heritage sites	Direct / Indirect	Purari River (2 receptors)	C	CHM001 CHM003	High^/Low	Moderate^
Ancestral heirlooms	Project employment and procurement	Potential loss of material culture, ancestral heirlooms and inventories through commodification as an induced impact of Project employment and procurement.	Induced	In and around PRL-15 and export pipeline route PAPs, PACs and local communities	C, O, D	CHM002 EM028	Medium / Low	Minor
		Potential loss of material culture etc.	Induced	River transport corridor PAPs, PACs and local communities	C, O, D	CHM005 EM028	Low / Low	Minor

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
Ancestral trail	Earthworks, vegetation clearance in borrow pit construction	Potential direct and/or indirect disturbance, loss of access, loss or damage to cultural heritage sites	Direct / Indirect	KP9 borrow pit and access track	C, O	CHM001 CHM003	High/Medium	Moderate
Intangible Cultural Heritage								
Language: Pawaia	Project employment and procurement	A potential decline in the use of local language and increased use of <i>Tok Pisin</i> .	Induced	In and around PRL-15 PAPs, PACs and local communities	C, O, D	CHM005 EM028	High / Medium	Moderate
Language: Koriki, Iare, Ahia, Kaimare, Maipua				River transport corridor PAPs, PACs and local communities			High / Medium	Moderate
Language: Orocolo				Export pipeline route PAPs, PACs and local communities			High / Negligible	Minor
Settlement (lookout)	Earthworks, vegetation clearance, logistics and transport	Potential changed traditional site use or access and; therefore, loss of ancestral knowledge related to identified and unidentified cultural heritage sites.	Direct	CPF	C, O	CHM001 CHM002 CHM003 CHM004 EM001 EM028 Salvage (undertaken)	Low/Medium	Minor
Oral tradition (ceremonial site)			Direct	Trunkline	C, O		High/Medium	Moderate
Oral tradition (ceremonial site + spirit tree)			Direct	Export pipeline route	C, O	CHM001 CHM002 CHM003	High/Medium	Moderate†
Oral tradition (ceremonial site + Initiation site)			Direct	Outside the trunkline Vegetation Clearance Area (VCA) but within the survey buffer	C, O	CHM004 EM001 EM028	High/Low	Moderate†
Oral tradition (ancestral village sites)	Aggregate dredging	Potential permanent loss or damage to cultural heritage sites	Direct	Hou Creek (Purari River)	C, O	CHM001 CHM003	High / Medium	Moderate

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / Indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
Oral tradition (ceremonial sites)	Aggregate dredging	Potential permanent loss or damage to cultural heritage sites	Direct	Hou Creek (Purari River)	C, O		Medium / Medium	Moderate
Oral tradition (spirit / ritual site)	Aggregate dredging	Potential indirect impact due to sediment plumes, disturbance to intangible cultural heritage	Indirect	Hou Creek (Purari River)	C, O	CHM001 CHM003	Medium / Minimal	Negligible
Oral tradition (settlement, burial sites, ceremonial sites or cemeteries)	Aggregate dredging	Potential restricted access, potential damage to site	Indirect / Direct	Hou Creek (Purari River, 3 receptors)	C, O, D	CHM001 CHM003	High / Low	Moderate
Oral tradition (ceremonial sites)	Earthworks, aggregate dredging	Potential indirect impact due to sediment plumes, disturbance to intangible cultural heritage	Indirect	Hou Creek (Purari River)	C, O	CHM001 CHM003	Medium / Minimal	Negligible
		Potential indirect impact due to sediment plumes, disturbance to intangible cultural heritage					High / Minimal	Minor
Oral tradition (ancestral village sites)	Aggregate dredging	Potential restricted access, disturbance to intangible cultural heritage	Direct	Hou Creek (Purari River)	C, O, D		High / Minimal	Minor
Oral tradition (spirit/ritual sites)	Aggregate dredging	Potential restricted access, disturbance to intangible cultural heritage	Direct	Hou Creek (Purari River)	C, O, D	CHM001 CHM003	High / Low	Moderate
Oral tradition and settlement	Dredging	Potential direct and/or indirect disturbance, loss of access, loss or damage to cultural heritage sites	Direct / Indirect	Purari River	C	CHM001 CHM003	High/ Medium#	Moderate
Oral tradition	Dredging		Direct / Indirect	Purari River	C	CHM001 CHM003	Low/ Negligible	Negligible
Oral tradition	Dredging	Potential direct and/or indirect disturbance, loss of access, loss or damage to cultural heritage sites	Direct / Indirect	Purari River	C	CHM001 CHM003	Medium/ Negligible	Negligible
Oral tradition	Dredging		Direct / Indirect	Purari River	C		Medium/Low	Minor
Oral tradition (ancestral village)	Earthworks, vegetation clearance in		Direct / Indirect	Near KP9 borrow pit and access track	C, O		High/ Negligible	Minor

Key Sensitivity / Receptor	Main Activity	Potential Impact	Direct / indirect	Location of Activity / Receptor	Project Phase	Mitigation and Management Applied	Residual Sensitivity / Magnitude	Residual Significance
	borrow pit construction							
Cultural practices and subsistence activities	Project employment and procurement	Potential changed traditional site use or access and; therefore, loss of ancestral knowledge related to identified and unidentified cultural heritage sites.	Induced	In and around PRL-15 PAPs, PACs and local communities.	C, O, D	CHM005	Medium / Low	Minor
Cultural practices and subsistence activities	Project employment and procurement	Potential disruption to or loss of the intergenerational transfer of cultural knowledge and practices.	Induced	In and around PRL-15 and river transport corridor PAPs, PACs and local communities.	C, O, D	CHM005	Medium / Low	Minor
				Export pipeline route PAPs, PACs and local communities.			Medium / Negligible	Negligible
Sacred site (Cultural and Spirit site)	Changes in river morphology and stability	Potential temporary changes in the morphology of sand banks	Direct	Purari River (Purivo Junction)	C, O	CHM003	High / High	Major

†To be confirmed pending confirmation of the local site significance and mitigation and management measures in consultation with NMAG and the Nemina clan.

^ To be confirmed pending confirmation of the local site significance.

A High impact magnitude was assigned for this for this site as a precaution, but reduced to Medium as it is anticipated that Project detailed design in conjunction with consultation with the community and NMAG will identify suitable mitigation and management measures for this site.

7 Cumulative and Transboundary Impacts

7.1 Overview

This section presents a synthesis of all Project documentation relating to cumulative and transboundary impacts. The EIS (2019), identifies six other major development projects in the region with the potential to contribute to cumulative impacts in the landscape, and describes the impacts, their significance and the required mitigation measures.

The CIA in the EIS (2019) is completed in line with the requirements of IFC PS1 and the guidance of the Good Practice Handbook for Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (IFC, 2013) (Henceforth, the “IFC Good Practice Handbook for Cumulative Impacts”).

The EIS (2019) prioritised the assessment and management of cumulative impacts by focusing on those values or impacts generally recognised as important due to scientific concerns or concerns of PACs. This approach places key environmental, social and cultural values at the centre 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 used baseline information gathered in preparation of the EIS (2019), findings from the discipline-specific impact assessments presented in the EIS (2019), and publicly available information on approved or proposed projects in the spatial boundaries. The EIS (2019) acknowledges that information on the specific activities or predicted impacts of the other credible development projects is limited, and as such, professional experience and an understanding of similar projects (e.g. PNG LNG, P’nyang Project) was key to the completion of the CIA.

7.2 Other Credible Development Activities

Scoping as part of the EIS (2019) identified seven existing, planned or reasonably anticipated activities or projects in the landscape (see Figure 7-1). These were:

- Baimuru Block 3 and Vailala Block 3 Logging Concessions
- PLC (formerly known as Mayur) Bulk Coal Sample Extraction/Depot Creek Coal Project
- PLC Orokolo Bay Industrial Sands Project
- PLC Central Cement and Lime Project
- ExxonMobil PNG Ltd LNG Facilities
- P’nyang Project (Esso PNG P’nyang Limited LNG Project)
- Ihu Special Economic Zone (ISEZ).

All seven projects were reviewed for their spatial and temporal relevance to the Project, i.e. were they close enough and happening at the same time as the Project, and therefore capable of making a cumulative contribution to Project impacts. The first six projects on this list were scoped into the CIA. However, the ISEZ was not considered, as although a master plan has been developed, no known financial commitments has yet been made by the PNG Government.

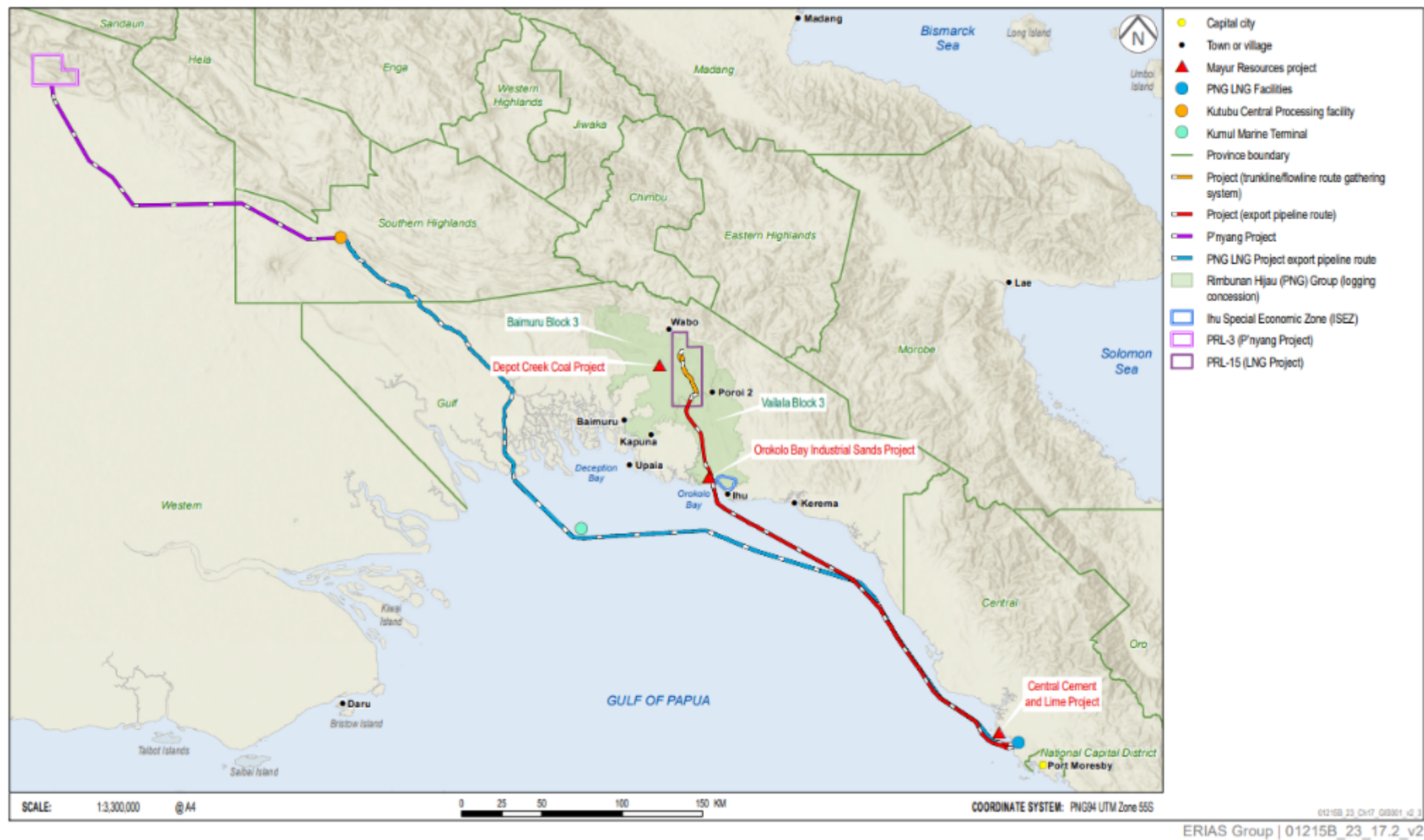


Figure 7-1: Map of credible projects used in cumulative impact assessment (Source: EIS, 2019). Note: Project has undergone footprint changes since 2019 and now includes the condensate pipeline described in the Project Description (Chapter 3).

7.3 Identifying Cumulative Impact Pathways and Values

The EIS (2019) then identified the potential impacting processes and values impacted by the Project and the six other scoped-in credible development projects. Table 7-1 describes the environmental, social and cultural values potentially impacted by each cumulative pathway, as well as the baseline sensitivity of each value.

Table 7-1: Cumulative impact pathways and values

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

7.4 Cumulative Impact Assessment

The EIS (2019) qualitatively evaluates the significance 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 the relevant chapters of the EIS (2019) have been implemented.

7.4.1 Climate Change and Climate Regulation

A GHG assessment and climate change study were undertaken as part of the EIS (2019), as described in EIS GHG & Climate Change Assessment, (2019). Based on the findings from that study, the CIA in EIS (2019) stated that emissions from the Project and other credible projects will contribute to global GHG concentrations that influence global atmospheric processes and changes to the global climate system. Potential impacts of climate change on the Project, including physical climate risks, resilience and adaptation measures, and impacts of the Project on climate change, have been re-assessed in the CCRA Synthesis Report (2025).

The findings from the CCRA Synthesis Report (2025) are summarised in the following section. Project-related vegetation clearing, gas production, transportation, and the operation of fixed and mobile equipment are projected to increase until 2023 after which they will plateau during the operational phase until 2045 after which they will gradually decline.

Over the life of the Project, Scope 1 emissions are expected to increase during the operational phase, reflecting declining reservoir pressure from around 2040 and the associated increase in energy required for gas extraction. Figure 7-2 below shows the estimated annual project Scope 1 GHG emissions from construction to decommissioning against the estimated annual LNG production figures. Emissions will peak in 2045 and then reduce as production declines, and the project enters decommissioning.



Figure 7-2: Estimated annual Scope 1 GHG emissions profile(Source: CCRA Synthesis report (2025))

The Project is anticipated to enter a decommissioning phase in 2050, with zero GHG emissions projected beyond 2051. Depending on the balance between emissions reductions in other sectors of PNG's economy and carbon sequestration from nature-based solutions, the Project could constitute a large proportion of the country's residual GHG emissions in the late 2040s.

Emissions from the Project will contribute to PNG's national GHG inventory and will place upward pressure on the country's emissions trajectory. However, PNG's Enhanced Nationally Determined Contribution (NDC) recognises the continued role of the oil and gas sector in the national economy and provides for emissions offsetting through nature-based solutions. The Enhanced NDC and the Sustainable Development Goal 13 Roadmap include provisions for developing carbon-neutral gas and mineral sectors and for introducing offsetting frameworks to support low-carbon development pathways.

Accordingly, while the Project is expected to contribute to national and global GHG concentrations, current projections indicate that it is partially aligned with PNG's carbon neutrality objectives and long-term

strategies under the Paris Agreement. The Project neither clearly undermines nor fully enables achievement of carbon neutrality by 2050, and its long-term contribution will depend on the effectiveness of national emissions reduction measures and carbon sequestration initiatives, CCRA Synthesis Report (2025).

Emissions from the Project and other credible projects will contribute to global GHG concentrations that influence global atmospheric processes and changes to the global climate system. As more resource projects are developed in PNG, Project-related clearing will continue to remove more native forest that currently acts as a GHG sink. The Land Use, Land Use Change and Forestry sector is one of the largest sectors in PNG's GHG emission inventory and historically has acted as a GHG 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 - CCRA Synthesis Report (2025).

7.4.2 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.

IUCN Critically Endangered Species

The little known and Critically Endangered timber tree species (*Diospyros lalinopsis*) 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.

The largetooth sawfish (*Pristis pristis*), the northern river shark (*Glyphis garricki*), and the speartooth shark (*Glyphis glyphis*) 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 impacts resulting from 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.

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 PLC for their Depot Creek Coal Project.

These species include the IUCN Endangered *Diospyros insularis* as well as 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.

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 localised to areas around access routes. No information is available relating to improved land access (i.e., roads or tracks) for PLC 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, and Scheepmaker's crowned pigeon are also sensitive to hunting. If the Project, PLC 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.

Sensitive Species

The EIS Addendum (2024) updates the Project's list of Species of Very High sensitivity (as initially described in the EIS (2019)) to include the following six species which could make them vulnerable to potentially significant regional population impacts from cumulative losses:

- *Orania longistaminodia*
- *Dolicholobium rufiflorum*
- *Begonia* sp. 5
- *Begonia* sp. 14
- *Psychotria heterophylla*
- *Myristica brachypoda*

The EIS Addendum (2024) identifies the following characteristics of these species that make them potentially vulnerable to significant regional population impacts from cumulative losses:

- Critically Endangered status, and/or,
- Very small known populations, and/or
- Highly restricted geographic ranges, and/or
- Strong dependence on intact forest habitats.

Commercially Important Species – Tropical Rock Lobster

The presence of the ExxonMobil 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. At the time of writing the CIA, undertaken as part of the EIS (2019), most potential impacts of the PNG LNG gas pipeline were unknown. Understanding of potential impacts has since evolved, as outlined below.

As described in the FEED Changes EAR (2025), due to the reduction in diameter of the export pipeline from 40 inches to 30 inches it is considered likely that lobsters will be able to traverse the pipeline. This is also supported by further rock lobster fishery surveys undertaken by the Australian Fisheries Management Authority since installation of the PNG LNG gas pipeline that have not shown a decline in lobster populations associated with that 34-inch diameter pipeline as a barrier – Worley (2023). The narrower 10-inch diameter condensate pipeline to the FSO is not expected to present a barrier to lobster migration.

7.4.3 Sensitive Focal Sites and Ecosystems

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 species 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. The main potential Project impacts to these softshell turtles will be as a result of induced-in migration generating additional hunting and habitat loss pressure.

Sensitive Ecosystems

Three very sensitive terrestrial ecosystems are present in the Project terrestrial biodiversity study area: hill forest on limestone, primary (unlogged) alluvial forest and mangrove.

For broader context, the RIA (2025) estimates that Project residual losses of forest and mangrove represent around 0.17% of the available, equivalent habitat types (approximately 696,894 ha of all forest and mangrove habitats) in the upstream terrestrial biodiversity study area.

While the predicted vegetation loss in these ecosystems due to Project activities is minimal, cumulative clearing associated with the credible projects identified as overlapping with the PAoI 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 compound the impact of any direct loss of sensitive ecosystems from clearing.

7.4.4 Water Quality

The EIS (2019) assessed 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. This assessment was validated via D&B ESIA (2025) which identified that the dredging operation poses a low risk of environmental harm to the receiving environment since the baseline investigation showed monitoring sites in the Lower Purari River area to be turbid throughout the year, and particularly during the wet season.

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. The EIS (2019) states that 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 (Section 6.8, Table 6-9 of this ESHIA Synthesis). 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 major rainfall and flooding events. As described in Section 6.7.6 of this ESHIA Synthesis, accidental spills are considered unlikely to occur. If they do, impacts are likely to be localised due to low contaminant volumes typically released by incidental spills and leaks. Impacts to water quality are expected to be short-term (i.e., days to weeks) after applying appropriate spill prevention, containment and cleanup measures. However, the severity of the impacts to water quality may be moderate depending on the nature of the contaminant.

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 Section 6.8 hazardous material releases entering the waterway at the same time and location are unlikely to occur (EIS Cumulative Impacts, 2019).

7.4.5 Landscape Character

The Gulf Province landscape is typical of PNG and comprises mountain scapes 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, as well as 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, changes such as the following:

- 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
- 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; 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.

7.4.6 Use of Land and Water for Livelihoods

The credible projects identified above 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.

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 (EIS Cumulative Impacts, 2019). 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 described above are unknown; however, given the extent of the licence areas identified, large areas of native vegetation could be cleared in and around PRL-15, and along the Oroko 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 Oroko Bay, where some resources (e.g., wild plants and timber) are already under pressure due to overharvesting or land use changes.

7.4.7 Community Health and Wellbeing

Section 6.13 outlines the potential for the Project to contribute to an increase in the frequency of diseases such as sexually transmitted infections, malaria and tuberculosis, and to increase the incidence of accidents and injuries. 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. If some or all the credible projects identified as

overlapping the PAol were to commence construction simultaneously, short-term, localised population in migration could increase the frequency, and risk of disease.

People earning higher incomes and with increased mobility (i.e., the projects' workforces) have a greater chance of participating in high-risk behaviours 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.

7.4.8 Access to Health and Education Services

Resource developments in PNG 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 credible projects identified above are unlikely to place additional pressure on the health and education services in the PAol. The PLC 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 PAol. If some or all the credible projects identified as overlapping the PAol were to commence construction simultaneously, short-term, localised population in migration could result; however, given the geographic spread of these projects, this is unlikely to result in a significant impact on 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, provided that 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.

7.4.9 Drinking Water

Many people in the PAol 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 higher quality 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 Oroko 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 PAol; 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 water supplies.

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

7.4.10 Traditional Practices and Language

PAol communities maintain intangible CH 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. Section 6.21 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.

7.4.11 Economic Security

Resource projects contribute substantially 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 PAol, 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 PLC developments in Gulf Province have, or are projected to have, small workforces, and are unlikely to contribute substantially 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 (EIS Cumulative Impacts, 2019).

An adverse impact of multiple resource projects operating simultaneously is that subsistence labour requirements for women and children, although potentially small, may increase, as men seek employment with different projects, and as such this may increase household 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.

7.4.12 Commercial Marine and River Traffic

The P'nyang LNG project could generate several hundred return barge trips over its construction period, using the Port Moresby to Kiunga shipping route. The Project will use the Port Moresby to Purari River route. This route could also be used by PLC's Depot Creek Coal Project and Orokelo Bay Industrial Sands Project, which would increase barge traffic along these nearshore shipping lanes and river transport corridor.

A cumulative increase in nearshore shipping increases the risk of marine or river accidents and/or accidental release of contaminants. Section 6.12 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 duration (approximately five years) over which most of the increase in shipping would occur.

Given the lack of publicly accessible information on the credible projects listed above, 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.

7.4.13 Airport Capacity

As per the EIS (2019), 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. Other credible projects, if they occur at the same time, are likely to require their workforce to fly through Port Moresby to regional airstrips/airports. This combined increase in demand could exert pressure on airport infrastructure and capacity, potentially affecting other users.

7.5 Proposed Mitigation and Management Measures

Step 5 of the CIA process outlined in EIS Cumulative Impacts (2019) involves the design of mitigation measures related to 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 CESMP and accompanying thematic management plans. 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.

7.6 Cumulative Impacts and Project Area of Influence

The spatial extent of the cumulative PAoI has been estimated on the basis of the maximum plausible geographic extent over which the Project could contribute to cumulative environmental change affecting shared receptors. The cumulative PAoI has been estimated in line with IFC PS1 and the IFC Cumulative Impact Guidance Note.

The IFC Cumulative Impact Guidance Note indicates that estimating cumulative impacts and defining geographic boundaries for a cumulative PAol involves inherent uncertainty due to incomplete knowledge of future developments, complex interactions among multiple activities, and limited understanding of ecological thresholds, and thus requires a precautionary approach and adaptive management as more information becomes available over time.

The principal purpose of defining the cumulative PAol at a broader scale is not to expand the Project's responsibility. Rather, it ensures that cumulative impacts to E&S receptors are assessed within their appropriate ecological and socio-economic context, particularly given the potential geographic evolution of predicted cumulative impacts during the Projects lifespan. Additionally, this approach allows for the Project's incremental contribution to wider landscape and community change to be transparently evaluated, and subsequently that management and monitoring measures are designed in proportion to the Project's actual contribution to cumulative pressures. Within this context, TEP PNG's role is not to assume sole responsibility for landscape-scale outcomes, but to take a leading role in catalysing and supporting partnerships with relevant stakeholders to manage cumulative impacts.

The geographic boundaries for the Project cumulative PAol, as seen in Figure 7-3, reflect the area within which cumulative impact pathways are reasonably foreseeable. They are defined based on the geographic extent of valued environmental and social components (VECs), and where those VECs could be subject to impacts by other past, present and reasonably foreseeable future developments, similar in nature to those of the Project. Direct Project impacts are also coloured in green in the map.

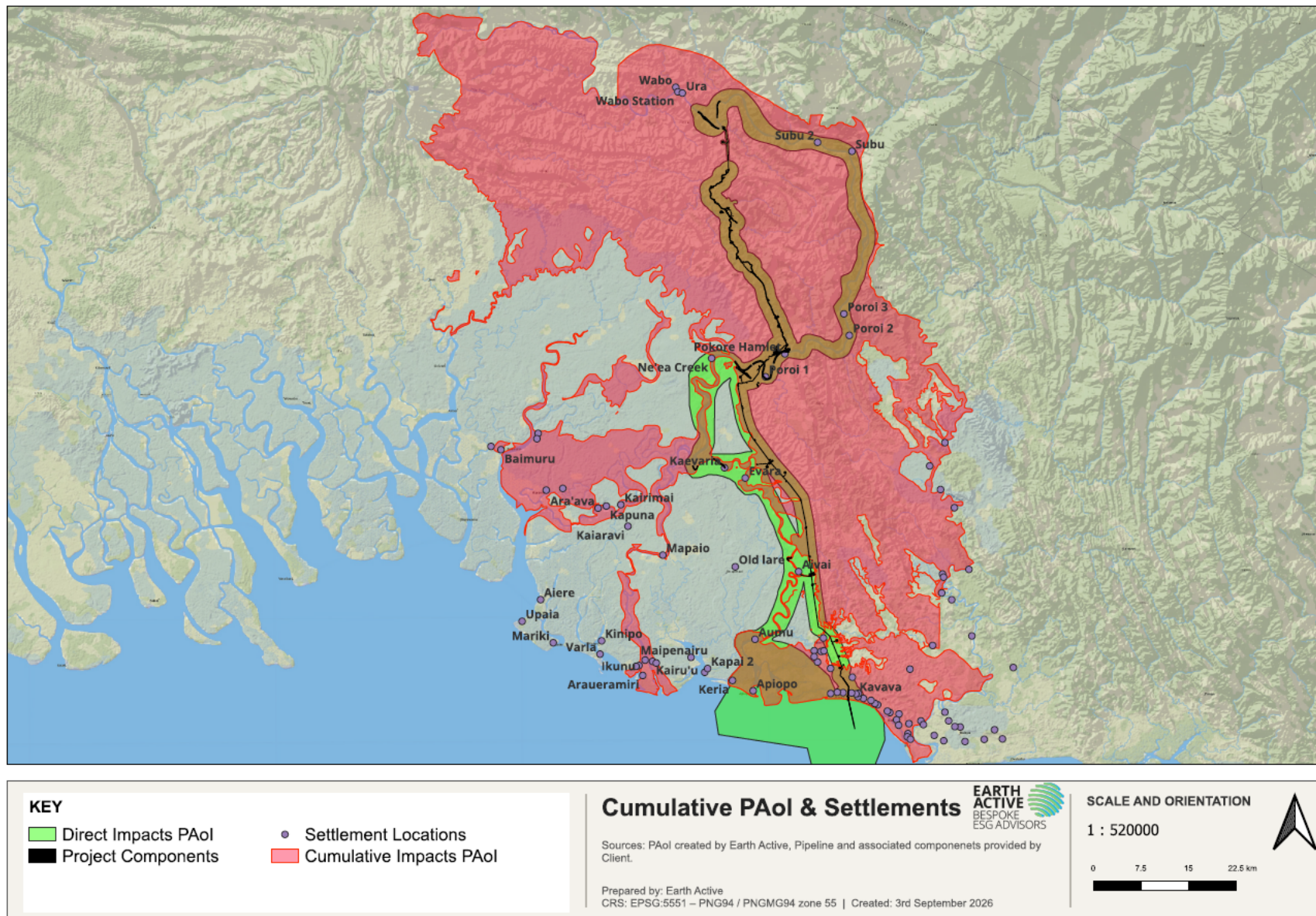


Figure 7-3: Cumulative PAol Map (Source: Earth Active, 2026)

One of the main determinants for the spatial extent of the cumulative PAoI relates to biodiversity and the potential cumulative effects to biodiversity in what is a contiguous, well connected and intact forest landscape, home to species and ecosystems of high conservation value. The Terrestrial CHA (2025) has qualified the entire Project landscape as Critical Habitat under IFC PS6 Critical Habitat Criterion 5 (Key Evolutionary Processes). The Project shares the landscape with third-party developments such as industrial extraction projects, third-party infrastructure and two large logging concessions (Baimuru Block 3 and Vailala Block 3, managed by Frontier Holdings Ltd and Turama Forest Industries respectively).

Therefore, the cumulative PAoI been estimated to include areas that share the same receptors and processes as those affected by the Project, and where those third-party activities could interact with Project-related activities to influence those receptors over time. These areas are as follows:

- Forest areas within neighbouring logging concessions that remain commercially viable (the EIS (2019), identifies alluvial and hill forest types as having the highest commercial value and are hence considered “commercially viable”) and may be subject to selective logging during the Project lifetime.
- Riverine and coastal systems that function as shared transport corridors or ecological linkages.
- Nearshore and estuarine environments where multiple developments interact with the same marine habitats and fisheries resources.

In defining the cumulative PAoI, areas that are ecologically distinct, unlikely to share the same receptors, or do not share disturbance pathways have been excluded, so that the delineation reflects functional relationships rather than administrative boundaries. As such, the cumulative PAoI includes areas of contiguous hill and alluvial forest that fall within these aforementioned logging concessions on the basis that all alluvial and hill forest within the two neighbouring concessions are tentatively at risk of future logging within the Project time horizon. It is also noted that the Project’s offset areas may in the future include areas within the neighbouring logging concessions which would help mitigate potential cumulative impacts within these forests.

As swamp forest is considered impractical to log and of lower commercial value, all areas of swamp forest have been excluded from the cumulative PAoI.

Additionally, both the riverine and marine portions of the cumulative PAoI include areas where Project activities interact with third-party developments along the Purari River system and Orokolo Bay coastline, including the Pacific Lime and Cements (PLC) Depot Creek Coal project, PLC Orokolo Bay Industrial Sands Project; and PLC Central Cement and Lime Project, as well as existing ExxonMobil PNG LNG infrastructure at Caution Bay. These activities share transport corridors, coastal landfalls and marine access routes, creating the potential for adverse cumulative effects on receptors such as sensitive estuarine habitats and water quality, and as such have been conservatively included within the cumulative PAoI. For social receptors the cumulative PAoI includes communities, particularly Growth Centres (Ihu, Baimuru, and Kerema), and regions that may experience combined social pressures such as reduced service availability and livelihood disruption, as well as compounded adverse impacts to fisheries and community resource use given the cumulative use of transport corridors and increased in-migration from multiple third-party developments in the region.

7.7 Cumulative and Transboundary Impacts Conclusion

PNG is a developing country that is well 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 CIA identified six potential impacting processes from six credible projects that could potentially impact identified key values. The EIS (2019) notes that some of these projects (i.e., the P’nyang LNG Project, the

Exxonmobil 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 EIS (2019) concludes that the Project's contribution to the potential cumulative impacts is predicted to be minor relative to the credible projects listed, recognising 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.

8 Environment and Social Management System (ESMS)

8.1 ESMS Overview

This section presents a synthesis of Project documentation relating to the Project ESMS. The Project ESMS is designed to provide a structured framework for systematically identifying, assessing, and managing health, safety, security, E&S risks, throughout the Project life cycle and PAoI. This section summarises the elements of the Project ESMS and its supporting documents.

The Project has an overarching system-level document (Papua LNG ESMS, 2025), supported by manuals, management plans and procedures that describe how E&S requirements are implemented in construction, operation and decommissioning phases. The Project ESMS is based on the TotalEnergies' established management system, One-MAESTRO (Management and Expectation Standard Toward Robust Operation) HSE management system, which is based on the Plan-Do-Check-Act (PDCA) model and aligned with ISO standards 9001:2015, 14001:2015 and 45001:2018.

The ESMS Manual (2025) outlines the elements of Project's ESMS, including:

- Policy and commitments
- Identification of risks and impacts
- Management programmes
- Organisational capacity and competency
- Emergency preparedness and response
- Stakeholder Engagement
- Monitoring and review

The structure of the Project's ESMS during the construction phase consists of:

- A Construction Environmental and Social Manual (CESM) (2025) outlining construction-phase processes and expectations
- Construction Environmental and Social Management Plans (CESMPs) detailing topic-specific mitigation, monitoring and reporting requirements (see Table 8-1)
- Contractor Implementation Plans (CIPs) to be prepared by EPC contractors to explain how they will meet the CESMP requirements
- Information management systems, procedures and templates used by operators and contractors.

A similar structure will be applied for Operations and Decommissioning phases of the Project.

8.2 Roles and Responsibilities

TotalEnergies EP PNG Limited (the Operator)

As the Upstream Operator, TEP PNG E&S management teams will oversee the Project's E&S responsibility, and will:

- Further develop and implement the Project's E&S management framework for the respective Project phases.
- Communicate expectations, including legal obligations, standards and targets that must be met, and the commitments of the workforce and contractors.
- Assist contractors in implementing the Project's ESMP.
- Train and induct the workforce and contractors appropriately.
- Support and monitor the implementation of the management measures throughout all Project phases and activities.
- Monitor defined performance indicators and evaluate results against performance objectives.
- Systematically audit and assess E&S management to evaluate conformance, compliance and integrity.
- Review management measures and strategies, and revise, adapt and improve the ESMP when necessary.
- Maintain management systems and documentation.
- Undertake regulatory and Lender reporting as required.
- Interface with government bodies and other authorities regarding HSE requirements.
- Maintain community engagements in relation to Project activities, grievances, and mitigation programs.

Contractors

Contractors play a central role in implementing the Project's E&S requirements and are responsible for delivering their scope of work in full alignment with the ESMS, ESMP and CESMPs. Their key responsibilities include:

- Implementing all mitigation and control measures through CIPs aligned with the EISs and CESMPs.
- Applying ESMS processes for monitoring, reporting, non-conformances, incident management, and Management of Change.
- Complying with the ESMP, contractual obligations, and all relevant legislative requirements.
- Accepting and implementing environmental, health and safety obligations that flow contractually from TEP PNG.
- Maintaining sufficient resources (staff, equipment, systems) to meet ESMP requirements.
- Ensuring CIPs clearly describe resources, responsibilities, training, competencies, mitigation measures, monitoring and reporting requirements.
- Regularly reporting to TEP PNG on environmental and social performance.
- Preparing topic-specific CIPs with appropriate controls and staffing levels, which must be reviewed and approved by Operators before work begins.
- Managing subcontractors to ensure they meet all CESM/ESMP requirements.
- Applying strict discipline to prevent accidents and protect health, safety and the environment.

8.3 Commitments and Controls

E&S mitigation measures identified in the EIS, and all subsequent Project ESIAs, were initially captured in the Project's Commitments Register.

Project E&S mitigation measures are described in the relevant sections of this ESHIA Synthesis.

Construction Environmental and Social Management Manual

The CESM (2025) will be implemented by TEP PNG who are responsible for the operation of the Upstream component of the Project and development of the Upstream CESMP. The CESM (2025) - which supersedes the CESM L2-PLN-SDV-29 (2023) - outlines the requirements for the CESMP, including:

- Applicable E&S standards
- Linkage between the EIS (2019) and the mitigation proposed in the CESMP
- An overview of E&S management measures including coverage of the required processes for commitment registers, contractor implementation plans, PCS and information management
- An outline of monitoring and evaluation process including the expected process for EPC contractors, auditing, addressing different levels of non-conformances, action tracking, and performance indicators
- Requirements for management of emergency preparedness and response
- Requirements for incident management and notification
- Process for Management of Change
- Reporting requirements to different stakeholders
- Coordination, organisation roles and responsibilities
- Minimum requirements for competency training and awareness.

8.4 Management Plans

The Upstream CESMP comprises a number of discipline-specific E&S management plans and procedures that describe how the impacts associated with the Project will be managed, consistent with the embedded design controls and mitigation and management commitments.

The main plans and procedures are listed in Table 8-1 below:

Table 8-1: List of Plans and Procedures

Document ID	Title
L2-PLN-SDV-01	Project National Content Plan
L2-PLN-SDV-05	Community Development Management Plan
L2-PLN-SDV-06	Community Health, Safety and Security Management Plan
L2-PLN-SDV-07	Cultural Heritage Management Plan
L2-PLN-SDV-08	Gender Management Plan
L2-PLN-SDV-09	Ecology Management Plan
L2-PLN-SDV-42	Land Access and Livelihood Development South
L2-PLN-SDV-44	Biodiversity Monitoring and Evaluation Plan
L2-PLN-SDV-13	Land Access and Livelihoods Framework
L2-PLN-SDV-17	Project Induced In-Migration Management Plan
L2-PLN-SDV-18	ICP-FPIC Implementation Plan

L2-PLN-SDV-21	Site Restoration and Rehabilitation Management Plan
L2-PLN-SDV-24	Stakeholder Engagement Management Plan
L2-PLN-SDV-26	Traffic and Transport Management Plan
L2-PLN-SDV-40	Indigenous Peoples Framework
L2-PLN-HSE-01	Affiliate Emergency Response Plan
L2-PLN-HSE-03	Oil Spill Response Plan
L2-PLN-HSE-06	Health Plan
L2-PLN-HSE-07	Waste Management Plan
L2-PLN-HSE-11	Chemical Management Plan.pdf
L2-PLN-MAR-01	River Traffic Management Plan
L2-PLN-HRA-01	Labour and Working Conditions Management Plan
L2-PRO-SDV-01	Land Access and Compensation Procedure
L2-PRO-SDV-02	Community Grievance Procedure
L2-PRO-SDV-04	Cultural Heritage and Chance Finds Procedure
L2-PRO-SDV-08	Quarantine Management Procedure
L2-PRO-SDV-09	Environmental Monitoring, Verifications , Audit and Reporting (EMVAR) Procedure
L2-PRO-SDV-10	Support to communities donation of HC product
L2-PRO-SDV-15	Cultural Heritage Survey and Salvage Procedure
L2-PRO-SDV-18	Land Access Request and Notice of Land Availability Process Procedure
L2-PLN-SDV-34	Biodiversity and Ecosystem Services Action Plan
L2-STR-SDV-01	Biodiversity and Ecosystem Services Strategy
PG-P15-00-PHSE-000008	Project Chemical and Hazardous Material Management Procedure
PG-P15-00-PHSE-000014	Project Emergency Response Procedure
PG-P15-00-PHSE-000009	Project Health Management Procedure
PG-P15-00-PHSE-000029	Project Air Emissions and Greenhouse Gas Management Procedure
PG-P15-00-PHSE-000030	Project Noise and Vibration Management Procedure
PG-P15-00-PHSE-000032	Project Waste Management Procedure
PG-P15-00-PHSE-000033	Project Site Restoration and Rehabilitation Management Procedure
PG-P15-00-PHSE-000034	Project Surface and Groundwater Management Procedure
PG-P15-00-PHSE-000035	Project Raw Materials Management Procedure
PG-P15-00-PHSE-000036	Project Soil Management Procedure
PG-P15-00-PHSE-000037	Project Acid Sulfate Soil Management Procedure
PG-P15-00-PHSE-000038	Project Invasive Species, Pathogen & Pests Management Procedure
PG-P15-00-PHSE-000039	Project Community Health, Safety & Security Management Procedure
PG-P15-00-PHSE-000041	Project Cultural Heritage Management Procedure
PG-P15-00-PHSE-000042	Project Traffic and Transport Management Procedure
PG-P15-00-PHSE-000043	Project Stakeholder Engagement Procedure
PG-P15-00-PHSE-000044	Project Labour and Working Condition Management Procedure
PG-P15-00-PHSE-000046	Project Spills and Accidental Release Management Procedure
PG-P15-00-PHSE-000048	Project Dredging Management Procedure
PG-P15-00-PHSE-000051	Project Ecology Management Procedure
PG-P15-00-PHSE-000052	Project Induced In-Migration Management Procedure
PG-P15-00-PHSE-000054	Upstream Construction Environmental & Social Management Plan
PG-P15-00-PHSE-000061	Project Recruitment Policy and Procedure
PG-P15-00-PHSE-000062	Project Workforce Disciplinary Procedure
PG-P15-00-PHSE-000063	Project Workforce Complaints and Grievance Procedure
PG-P15-00-PHSE-000064	Project Workforce Demobilisation Procedure
PG-P15-00-PHSE-000065	Project Camps Standards and Working Conditions Procedure

PG-P15-00-PHSE-000066	Project Industrial Relations Monitoring Policy and Procedure
PG-P15-00-PHSE-000078	Project Industrial Action Management Procedure
PG-P15-00-PHSE-000079	Hou Creek Aggregate Dredging Management Plan

8.5 Construction and Contractor Management

The Project's ESMS (2025), CESM (2025) and CESMPs lay the foundations for managing contractors E&S implementation during the construction phase. Contractors will be required to submit their own CIPs for works, which are specific to their scope which detail the specific nature of their planned activities' mitigations and control measures. These CIPs are to be submitted to Company for approval prior to activities commencing.

8.5.1 Coordination Arrangements

The coordination arrangements, organisational structure, and specific roles and responsibilities for implementing the CESM are set out in detail in the Operator's CESMPs.

The Project is overseen by two key committees:

- **Operating Committee** – provides overall supervision and direction for joint operations and meets at least quarterly.
- **Technical Subcommittee** – supports the Operating Committee by reviewing technical matters related to Project licences and making recommendations. Issues that cannot be resolved are referred back to the Operating Committee.

Close coordination between the Upstream and Downstream Operators (see Section 3.1 – Project Description – for detail) is essential, particularly at key construction interfaces such as Caution Bay and the tie in area. Regular meetings and workshops ensure alignment of E&S strategies, plans, procedures, monitoring and reporting.

8.6 Monitoring and Reporting

Monitoring and evaluation will be undertaken to determine:

- Whether mitigation measures are being implemented
- Whether they are effective
- Whether actual impacts align with EIS predictions
- Whether the Project is complying with applicable Environmental and Social Requirements
- Whether corrective actions are appropriate and required

Monitoring will include observations, inspections, surveys, sampling and verification. EPC contractors are to carry out internal monitoring, while TEP PNG undertakes independent verification, assessments, and audits. Monitoring also includes activities associated with designated Associated Facilities (see Section 3.6 for more on Project designated Associated Facilities), where appropriate.

Monitoring results are recorded in information management systems and reviewed periodically; required corrective or improvement measures are tracked until closure.

Monitoring is a key component of the ESMS and is required to determine the effectiveness of the design, and construction and operational measures implemented to mitigate predicted E&S impacts. Monitoring will consider internal and regulatory requirements, including the environment permit conditions.

Long term biodiversity monitoring will allow validating the accuracy of predicted impacts and predicted outcomes of the Project's mitigation measures on biodiversity features. The BMEP outlines the set of monitoring requirements and thresholds to implement adaptive management, shall it be required.

The Individual CESMPs and the Environmental Monitoring Verification Audit and Reporting (EMVAR) procedure contain details of the monitoring approach and relevant performance indicators. Inspections and audits of contractor activities form a key component of the ESMS and include self-assessment and assessment of the contractor at regular intervals by TEP PNG or external independent resources. Audit frequency depends on the HSE risk level of the contracted services, as defined in TEP PNG's HSE requirements for contractors. A corrective action plan will be established when non-conformance or non-compliance is identified.

8.6.1 Regulatory Reporting

Each Operator is responsible for meeting all regulatory reporting obligations associated with their permits and licences. This includes preparing and submitting reports to the relevant authorities using the structure, content and format agreed with those authorities. Operators must comply with all legal and regulatory reporting requirements for their respective worksites and permitted activities.

8.6.2 Internal Routine Reporting

EPC contractors will provide routine reports directly to TEP PNG on the progress and outcomes of their E&S performance, as required in their CIPs. Outputs from implementing the CESMP, including non-conformances, non-compliances and grievance-related issues, are shared periodically between Operators and presented to the Project Technical Committee.

This may include, but is not limited to, performance indicators such as:

- Incident notifications
- Cultural heritage, threatened species and contaminated land chance finds
- Notifications and reports submitted to PNG agencies
- Status of non-conformances and observations from verification and monitoring
- Assessment and audit reports
- Grievance management (Worker and community)
- Stakeholder engagement activities
- Outcomes of PNG agency inspections
- Waste volumes generated onsite
- Fresh water usage
- Fuel consumption
- Raw material volumes (e.g., quarries)

8.6.3 Non-Conformances

As per the CESM (2025), non-conformances are identified, recorded and tracked within Operator databases. The Project uses a three-level non-conformance system plus a Field Observation category:

- Field Observation – potential non-conformance
- Level I – non-conformance unlikely to cause damage
- Level II – non-conformance with observed or reasonably expected damage
- Level III – critical non-conformance with significant or potentially significant damage

Corrective actions, investigations and stop-work orders are applied as defined in the CESM (2025).

Non-conformance reporting to the IESC/Lenders follows strict timelines, including notification of Level III non-conformances within three business days.

8.6.4 Performance

Performance indicators will be used to measure how effectively the mitigation measures in their CESMPs are being implemented. These indicators fall into two types:

- Leading indicators identify potential issues or risks before an incident occurs.
- Lagging indicators reflect events or conditions that have already happened and help assess whether existing policies or practices need adjustment.

EPC contractors (and their subcontractors) may include additional performance indicators within their CIPs. All indicators must be meaningful, measurable, and designed to track the effectiveness of mitigation measures.

8.6.5 Incident Management and Notification

The CESM (2025) outlines incident categorisation and the process which must be followed in the event of an incident relating to health/injury, security, environment as well as public disruption. All incidents and near misses must be immediately reported. Incident management includes:

- Incident categorisation
- Notification (internal/external)
- Investigation and causal analysis
- Corrective actions
- Reporting
- Tracking
- Lessons learned

Serious incidents following defined criteria, must be reported by TEP PNG to the appropriate PNG authorities and to all IESC/Lenders.

Emergency response arrangements include Operator Emergency Response Plans and mutual-aid provisions between Operators where appropriate.

8.7 Management of Change

Management of Change (MoC) procedures are to apply to all material changes whether permanent, temporary or emergency changes that may affect E&S performance. The Project is to maintain MoC registers and prepare periodic reports summarising the nature of each change, the rationale, associated risks, mitigation measures and implementation status.

The MoC procedure ensures:

- Formal evaluation of the proposed change
- Identification and control of new risks
- Communication and training for affected personnel
- Updating of documentation
- Reporting of material changes to regulators and the Lenders' representative

8.8 Training and Awareness

The Project Operator and EPC contractors will assess training needs related to the CESM and contractor documents. Minimum E&S, and health and safety, training requirements are defined in each Operator's CESMP. Training programmes are developed and maintained by the Operators and their EPC contractors and include several levels of competency depending on personnel responsibilities.

Training types include:

- **Induction:** For visitors, covering key E&S, and health and safety, aspects, controls and instructions specific to each location and worksite.
- **General awareness:** For personnel without direct Environmental Management Plan (EMP) / Social Management Plan (SMP) duties, providing an overview of key E&S aspects, controls and relevant instructions.
- **Management awareness:** For management and supervisory staff, covering key aspects of relevant EMPs and/or SMPs.
- **Job-specific training:** For personnel with direct EMP/SMP duties, explaining specific components of the plans and related individual responsibilities.

9 Conclusion

This Synthesis is desktop-based and consolidates the Project's E&S assessments. It draws on the extensive body of Project documentation produced since the EIS (2019), EIS Addendum (2024), FEED change assessments, and specialist topic studies. Impact identification and significance evaluation aim to align with PNG regulatory requirements and international standards, including the IFC PSs, EPs, and OECD Common Approaches.

The Project is located in a remote, environmentally and socially sensitive area characterised by customary land tenure, high dependence on land/riverine/marine resources, and the presence of Indigenous Peoples with strong cultural and livelihood ties to the PAoI. The total disturbance footprint, across onshore and offshore components is approximately 2,453 ha, including approximately 190 ha on previously disturbed land. Approximately 1,280 ha is planned as temporary with post-construction rehabilitation.

Most E&S risks are driven by construction activities and are expected to be localised; with application of the mitigation hierarchy and delivery through the Project's ESMS and topic-specific plans, residual impacts are generally considered manageable, though some remain significant due to high-sensitivity receptors and permanent infrastructure.

Key environmental risks include habitat loss/fragmentation (including CH-qualifying forest), sedimentation and water-quality changes (notably in the Purari River system), noise (including underwater noise), waste generation, increased riverine/marine traffic, and invasive species. Residual impacts are predominantly Minor to Moderate, with Moderate residual impacts linked to permanent vegetation loss, geomorphological change/sedimentation from dredging and vessel movements, and localised permanent loss of riverine/marine habitat. Through the Project BESS, the Project is committed *"To achieve a measurable and long-term Net Gain in Critical Habitat-qualifying features (e.g., species and ecosystems) and to maintain the value and functionality of priority ecosystem services that may be impacted by its operations."*

Low-likelihood, high-consequence major hazard events (fires, explosions, toxic release, seismic damage, spills) are addressed via safety-by-design, ALARP risk management, and emergency/oil-spill/blowout contingency planning. Construction emissions are dominated by carbon stock loss from clearing (reported as <2% of lifetime Scope 1), while operational emissions are driven by power generation and flaring/venting, with mitigation including no routine flaring, efficiency measures, and acid gas reinjection (reported at ~18,000 kt CO₂e). Physical climate risks (flooding, extreme rainfall, heat, coastal processes) may intensify beyond 2030, requiring resilient design and adaptive maintenance; transition risks may increase under faster decarbonisation pathways.

Moderate residual social risks persist for CHS along transport, dredging and barging corridors (especially the Purari River), including navigation safety, disease transmission, and pressure on services; project-induced in-migration may heighten social vulnerability and gender-based violence risks, requiring sustained prevention and monitoring. Impacts are shaped by Indigenous social systems and customary governance: displacement risk is expected to be predominantly economic, arising from restrictions on access to land, rivers, fisheries and subsistence resources, with residual livelihood impacts generally Minor to Moderate after compensation and livelihood planning.

A Major residual cultural heritage impact is identified at Purivo Junction (Purari River), where changes to sandbank morphology intersect with a sacred site of very high sensitivity, requiring avoidance where feasible, CHMP implementation, and long-term adaptive management.

Overall, predicted impacts are largely construction-driven and localised and are considered manageable through the ESMS provided mitigation is implemented effectively; critical dependencies include sustained community engagement (ICP/FPIC), robust CHS and river-safety controls, transparent land access and

livelihood measures, delivery of biodiversity offsets, and continuous monitoring and adaptive management across the Project lifecycle.

Appendix A: Project Area of Influence

Table 1: Summary of Environmental Impact Pathways and Associated Spatial Extent

Topic	Impact Type	Impact Pathway	Impacts	Receptors	Components	Spatial Extent within PAOI
Noise and Vibration	Direct	Construction noise;	Exceedance of night-time noise targets under enhanced propagation scenario during onshore pipeline construction and nighttime pilling noise at Orokolo Bay	Terrestrial fauna; nearby villages and isolated residences	onshore pipeline; Orokolo Bay	1,300m buffer around onshore pipeline and 2.5km buffer around pilling locations at Orokolo bay (only terrestrial)

Soils and Geology	Direct	Earthworks, trenching, aggregate extraction and spoil placement	Erosion, soil instability, increased sedimentation, drainage issues and potential landslides	Soils, landforms and downstream watercourses	CPF; wellpads; export gas pipeline; borrow pits; trunklines; spoil sites	Direct footprints of contributing components and adjacent areas subject to erosion or instability - Adjacent areas where localized disturbance is expected yet to be fully spatially defined. Currently for borrow pits these are defined as direct disturbance areas at 7ha (with KP9 at 4ha). For the CPF this is defined as 1km reach of waterways between the CPF footprint and the Purari river
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	Direct	Exploratory geotechnical excavation	Localised soil disturbance	Soil and subsoil	Legacy Areas	Footprint of Legacy Areas and adjacent areas subject to erosion or instability - Adjacent areas yet to be fully spatially defined
Hydrology	Direct	Accidental hydrocarbon or chemical release during river transport	Deterioration of surface water quality	Purari River	River transport corridor: Hou Creek Aggregate	Inclusion of the Purari River transport corridor; and Hou Creek Aggregate sourcing areas
Hydrogeology	Direct	Onshore pipeline trenching intersecting shallow groundwater	Temporary minor reduction in groundwater quality (exceedance for manganese, ammonia and total nitrogen)	Caution Bay coastal communities; shallow aquifers	Export Gas Pipeline; Caution Bay Shore crossing	Inclusion of affected coastal villages along the onshore pipeline route and landfall areas
Landscape and Visual Amenity	Direct	Vegetation clearing, earthworks, shore crossing works; development of temporary facilities	Temporary alteration of landscape character and viewshed disturbance	Landscape character; nearby communities	CPF; herd base; wellpads; export gas pipeline; borrow pits; access roads; temporary facilities	Direct disturbance footprints and surrounding viewshed where visible- Viewshed is yet to be fully spatially defined although given dense surrounding vegetation this impact is likely covered through the 200m buffer around project components
	Direct	Establishment and operation of pipe yard and construction camps	Temporary viewshed disturbance	Aivai village	Export Gas Pipeline; temporary facilities	Inclusion of Aivai village and immediate surroundings - immediate surroundings yet to be fully spatially defined

	Direct	Permanent infrastructure, lighting and permanently cleared RoW	Long-term alteration of landscape character	Landscape character	CPF; wellpads; herd base; export gas pipeline; access roads; Purari Airstrip	Inclusion of viewshed of permanently maintained Project areas - Viewshed is yet to be spatially defined although given dense
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						surrounding vegetation this impact is likely covered through the 200m buffer around project components
	Direct	Operation of major infrastructure including flare and vent stacks	Prominent visual elements above the treeline	Landscape character; Pokore hamlet	CPF	Inclusion of a viewshed buffer of 1.5km from CPF to reflect the maximum extent (range between 800m -1500m of impacts classified above negligible on receptors (Pokore hamlet)
	Indirect	Increased barge and vessel traffic associated with construction logistics	Increased visual activity along rivers	Villages along the Purari and Urika-Ivo rivers	Purari River transport corridor; Urika-Ivo River transport corridor	Inclusion of the Purari and Urika-Ivo river transport corridors
	Cumulative	Combined night-time lighting from Project and third-party developments	Incremental increase in artificial lighting	Terrestrial, freshwater and marine fauna; coastal communities	PLC Orokolo Bay Industrial Sands Project; PLC Central Cement and Lime Project; ExxonMobil PNG LNG facilities	Inclusion of PLC Orokolo Bay Industrial Sands Project, PLC Central Cement and Lime Project, and Caution Bay ExxonMobil PNG LNG facilities

Marine – Physical	Direct	Trenching and burial of offshore pipelines and associated vessel operations;	Short-term increase in turbidity and suspended sediments; localised seabed disturbance and scour from propeller wash and anchoring; temporary increases in underwater noise	Seabed; marine environment	Export Gas Pipeline; Condensate Pipeline; Pipelay and support vessels	Inclusion of nearshore and offshore pipeline construction corridors (export gas and condensate), defined as approximately 4 km wide (2 km either side of the pipeline centreline),
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	Direct	Pipeline landfall and nearshore burial works	Disturbance to coastal processes and soft sediments	Coastal & estuarine environment	Export Gas Pipeline; Condensate Pipeline	Inclusion of the Orokolo Bay, shoreline and caution bay landfall, and immediately adjacent nearshore area . Adjacent areas are yet to be fully spatially defined
	Indirect	Vessel movements for inspection and logistics	Wake effects and temporary underwater noise	Soft sediments; marine environment	Support vessels	Inclusion of Project maritime vessel transit routes - This is yet to be fully spatially defined
Terrestrial Biodiversity	Direct	Vegetation clearing, earthworks, infrastructure development, trenching, traffic, noise and lighting	Habitat loss, fragmentation and degradation; loss of focal features; barrier effects; fauna mortality and disturbance; contamination of terrestrial environments	Terrestrial habitats; sensitive flora and fauna	All terrestrial Project components	Inclusion of Project component footprints plus a precautionary 200 m edge-effects buffer around all Project-related clearings
	Direct	Permanent maintenance of linear infrastructure	Barrier effects on fauna movement and connectivity	Terrestrial fauna	Export Gas Pipeline; access roads	Inclusion of permanently maintained RoW and access roads
	Indirect	Induced access, population influx and changes in livelihoods and subsistence activities	Increased hunting pressure; forest resource exploitation, land clearing for housing and gardens; spread	Terrestrial fauna; ecosystems near communities and access routes	Access roads; camps; transport corridors	Inclusion of areas influenced by Project-induced access and population influx, extending beyond the component footprints - This is yet to be fully spatially defined

			of invasive alien species			
	Cumulative	Combined land clearing, infrastructure development, lighting, increased access, population influx and traffic from the Project and nearby third-part project developments	Incremental habitat loss, fragmentation and degradation; increased edge and barrier effects; light pollution affecting sensitive species; increased hunting pressure and spread of invasive species associated with improved access; cumulative disturbance to connected terrestrial ecosystems	Sensitive terrestrial flora and fauna species; regional habitat connectivity and functionality	All terrestrial project components; Rimbunan Hijau (PNG) Group forestry concessions (Frontier Holdings Ltd and Turama Forest Industries); PLC Bulk Coal Sample Extraction/Depot Creek; PLC Orokolo Bay Industrial Sands; PLC Central Cement and Lime; Onshore ExxonMobil PNG LNG facilities	Conservative inclusion of the full extent of the existing forestry concession (recognising landscape connectivity and potential expansion into the Purari area), Inclusion of area near Caution Bay encompassing the Central Cement and Lime Project and existing ExxonMobil PNG LNG facilities
Freshwater Biodiversity	Direct	Earthworks and infrastructure development	Direct loss and fragmentation of freshwater and riparian habitat within the CPF footprint	Freshwater habitats; Sensitive freshwater flora and fauna species	CPF	Inclusion of freshwater habitats within and immediately adjacent to the CPF footprint

	Direct	Ground disturbance and spoil stockpiling	Increased suspended	Sensitive freshwater flora	CPF; spoil stockpiles	Inclusion of waterways directly adjacent to construction sites
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			sediment and in-stream sedimentation causing smothering of aquatic fauna and habitats in tributary streams	and fauna species; freshwater benthic habitats; tributary streams		and downstream affected by sediment transport
	Direct	In-river dredging and disposal of dredge material	Localised disturbance of freshwater habitats and temporary deterioration of water quality	Sensitive freshwater flora and fauna species; Freshwater habitats	River transport corridor; Dredging locations; Hou Creek aggregate dredging areas	Inclusion of dredging locations and downstream sections of affected waterways and associated buffers as defined by the Dredging and Barging Impact Assessment Aol (BMT, 2025) and Hou Creek EAR (ERIAS, 2025)
	Direct	Discharges (e.g. bilge water, hydrotest water, drilling muds, aggregate processing water)	Contamination of freshwater environments	Sensitive freshwater flora and fauna species; freshwater habitats	River transport corridor; Export Gas Pipeline; Borrow pits	Inclusion of areas where potential discharge could occur and downstream areas from these points - This is yet to be fully spatially defined
	Indirect	Increased access and river traffic associated with construction activities	Increased disturbance and pressure on freshwater species; Increased fishing/egg gathering pressure; introduction of alien invasive species;	Sensitive freshwater fauna species; fisheries	River transport corridor	Inclusion of areas influenced by Project-induced access and population influx, extending beyond the component footprints - These areas are yet to be fully spatially defined

			Increased vessel collision risk			
	Cumulative	Combined infrastructure development, increased access, population influx and river traffic from the Project and nearby third-party project developments	Incremental habitat loss, fragmentation and degradation; increased edge and barrier effects; increased fishing pressure and spread of invasive species associated with improved access; cumulative disturbance to connected freshwater ecosystems; increased collision risk	Sensitive freshwater and estuarine flora and fauna species; regional habitat connectivity and functionality	River transport corridor; components; Rimbunan Hijau (PNG) Group forestry concessions (Frontier Holdings Ltd and Turama Forest Industries); PLC Bulk Coal Sample Extraction/Depot Creek; PLC Orokolo Bay Industrial Sands; PLC Central Cement and Lime; Onshore ExxonMobil PNG LNG facilities	Inclusion of Purari River transport corridor and connected river transport corridors for forestry concessions and PLC Depot Creek Bulk Coal project, as well as coastal/ estuarine areas near Caution Bay and Orokolo Bay encompassing the Central Cement and Lime Project, Orokolo Industrial Sands project, and existing ExxonMobil PNG LNG facilities

Marine Biodiversity	Direct	Trenching and pipelaying of offshore pipelines, pilling seabed disturbance and sediment resuspension	Direct loss and disturbance of benthic habitats and fauna (e.g. molluscs, worms, crustaceans); temporary increases in underwater noise & vibration;	Benthic habitats; benthic and demersal fauna	Export Gas Pipeline; Condensate Pipeline; Orokolo Bay; Caution Bay	Inclusion of nearshore and offshore pipeline construction corridors, defined as approximately 4 km wide (2 km either side of the pipeline centrelines), as well as exclusion zones from 2025 nearshore noise assessment
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			temporary increases in suspended sediment and deposition causing smothering of benthic habitats			
	Direct	Installation of offshore infrastructure	Localised seabed disturbance	Marine habitats	FSO; PLEM	Inclusion of the FSO riser and PLEM footprints with a surrounding 500 m exclusion zone
	Direct	Planned discharges (treated hydrotest water, domestic wastewater, bilge water) and accidental releases	Localised deterioration of water quality with potential sub-lethal or toxic effects on marine biota	Marine fauna; marine habitats	Pipelines; Vessel transport routes	Inclusion of discharge locations and surrounding marine waters - these areas are yet to be fully spatially defined
	Indirect	Vessel movements associated with dredging, pipelaying and support activities	Increased vessel collision risk; introduction and spread of marine pests and diseases	Marine fauna; Marine ecosystems	Vessel transport routes	Inclusion of maritime vessel transport routes and operational areas - these areas are yet to be fully spatially defined
	Cumulative	Overlap of Project and existing PNG LNG pipeline corridors and proximity of coastal industrial developments	cumulative disturbance and habitat loss affecting sensitive coastal habitats near Caution Bay,	sensitive coastal and nearshore habitats	Caution Bay Landfall; ExxonMobil PNG LNG pipeline; PLC Central Cement and Lime Project	Inclusion of coastal and nearshore habitats around Caution Bay encapsulating the Central Cement and Lime project's AoI

Table 2:- Refinements Social Elements of the PAOI

Topic	2019 EIS PAOI Spatial Definition	Current PAOI Spatial Definition	Rationale
Overall Social PAOI Extent	PRL-15 licence area; onshore export pipeline corridor; Purari River transport corridor; Orokolo Bay and Caution Bay coastal areas, including villages functionally linked through land, riverine and marine use.	Mostly unchanged, inclusion of new elements outside of pre-FEED PAOI, and cumulative impacts	Social receptors remain organised around the same land, river, and coastal systems assessed in 2019, with no new regional social systems added, and as such the social PAOI remains largely unchanged. Updates relate only to new Project elements post FEED, and cumulative impacts.
Condensate Export Pipeline	Condensate transport previously assessed under previous alignment (in line with PER)	Addition of a discrete offshore condensate pipeline corridor alignment extending from Orokolo Bay towards the offshore PLEM and FSO, with associated temporary and safety exclusion zones.	FEED changes introduce a new linear marine corridor. Inclusion is spatially limited to areas intersected by the 4km wide condensate pipeline corridor and 500m exclusion zones surrounding the FSO and PLEM, affecting marine access and fisheries for marine clans.
Coastal Villages – Orokolo Bay, Caution Bay	Coastal villages adjacent to pipeline landfall and nearshore works.	Includes Orokolo Communities: Harevavo, Marea, Larihairu, Kaivu, Kovu, Huruta, luku and associated Orokolo/Muro coastal clans. Includes Caution Bay Coastal Communities: Kido, Papa, Lea Lea, Boera, and Porebada	These villages lie along the Orokolo Bay and Caution Bay shoreline and nearshore marine use areas intersected by landfall works, marine traffic and the condensate and export gas pipeline corridors and will face reduced fisheries access and gleaning. Inclusion reflects direct spatial overlap with nearshore works impacts and cumulative impacts due to PLC Orokolo Industrial Sands project and PLC Central Cement and Lime Projects (Caution Bay).

Appendix B: References

Project documentation

The following table details the Project documentation provided to EA and used to inform this ESHIA Synthesis:

Note: where applicable, Project documentation that was cited within sources provided to EA, but not provided for review, is footnoted within the ESHIA as 'cited but unseen'. These documents are not listed below.

Document Title	File Name	Document publish date	References
Acid Sulfate Soil Management Procedure	AC 30c_L2-PLN-SDV-03_Acid Sulfate Soil Management Procedure	2023	Acid Sulfate Soil Management Procedure, 2023
Affiliate Emergency Response Plan	L2-PLN-HSE-01 - R2 - Affiliate Emergency Response Plan.pdf	2023	Affiliate Emergency Response Plan, 2023
Aggregate Sourcing Approach	Aggregate sourcing report	2023	Aggregate Sourcing Approach, 2023
Air Emissions & Greenhouse Gas Management Plan	AC 31b_L2-PLN-SDV-04_Air GHG Management Plan	2023	Air Emissions & GHG Management Plan, 2023
Air Emissions & Greenhouse Gas Management Procedure	AC_31a_Air GHG Mgt Proc_PG-P15 00 PHSE 000029	2023	Air Emissions & GHG Management Procedure, 2023
Aivai Village Fisheries Profile	Upstream Community Fishery Study Profiles (batch one 14 of 22)	2025	Aivai Village Fisheries Profile, 2025
Alternative Assessment Report (Draft) v3 (Erias)	M_2 _Alternatives Assessment_01215E_72_v3_	2023	Alternatives Assessment, 2023
Anti-Corruption Compliance Third Party Due Diligence	C&P Due diligence process.pdf	2024	Anti-Corruption Compliance Third Party Due Diligence, 2024
Application for Amendment to Environmental Permit EP-L3(584) and Notification of Intention to Carry Out Preparatory Works for Kutubu Pipeline	EAR initial 2022 FSO design.pdf	2022	Application for Amendment to EP-L3(584) & Preparatory Works Notice - Kutubu Pipeline, 2022
Archaeological Salvage Excavation Report Site - PUR059 - Preparatory Works Area	O5d_01215E_22_PUR059 Salvage_v3	2022	Archaeological Salvage Excavation Report - PUR059 Preparatory Works Area, 2022

Associated Facilities	PAPUA LNG AF REV0 2025_09_05	2025	Associated Facilities, 2025
AureScarp - Weed and Vegetation Assessment Report	AC_32b_Memo_AureScarp_Weed and Vegetation Assessment_Report_20230207	2023	AureScarp Weed & Vegetation Assessment Report, 2023
Barge Wake and Noise Assessment	Barge Wake and Noise Assessment - 01215E_66_v4.pdf	2023	Barge Wake & Noise Assessment, 2023
BES Resource Mapping - Project Map - Satellite Imagery R01	2025 - 17 - HSSE13 - BES Resource Mapping - Project Map - Satellite Imagery - 20250206 - R01	2025	BES Resource Mapping - Project Map - Satellite Imagery R01, 2025
Biodiversity and Ecosystem Services Policy	F_2022-07-01_TEEP PNG_Biodiversity and Ecosystem Services Policy	2022	Biodiversity Policy, 2022
Biodiversity and Ecosystem Services Strategy	L2-STR-SDV-01 R0 Biodiversity and Ecosystem Services Strategy	2023	Biodiversity & Ecosystem Services Strategy, 2023
Biodiversity Comparison Site Survey	Biodiversity Comparison Site Survey_2024 v3	2024	Biodiversity Comparison Site Survey, 2024
Biodiversity Performance Monitoring (NatureMetrics)	Marine eDNA baseline 2024.pdf	2024	Biodiversity Performance Monitoring (NatureMetrics), 2024
Borealis & Community Concerns & Grievance Mechanism Training	2024 Oct 29 HCR CLO CCGM Training HB	2024	Borealis Community Concerns & Grievance Mechanism Training, 2024
Borealis Communications Extract 2015-2016	Borealis Communications_2015 - 2026.xlsx	2026	Borealis Records
Borealis Grievances 2016-2026	Borealis Grievances_2016 - 2026.xlsx	2026	Borealis Grievance Records
BSE Community Concerns & Grievance Mechanism Procedure Awareness Training	BSE HB L2-PRO-SDV-02 CCGMP Awareness Training Oct 2023	2023	Community Concerns & Grievance Mechanism Procedure Training , 2023
Cane Toad Management Procedure	L4-PRO-SDV-05 R0 Cane Toad Management Procedure.docx.pdf	2024	Cane Toad Management Procedure, 2024
Caution Bay Habitat Assessment	Caution Bay (South) Habitat Assessment 2023	2023	Caution Bay (South) Habitat Assessment, 2023
Caution Bay Nearshore Marine Habitat Assessment	Caution Bay Nearshore Marine Baseline 2023	2024	Caution Bay Nearshore Marine Habitat Assessment, 2024
Chemical and Hazardous Material Management Plan	AC_37b_Chemical and Hazardous material MP_L2-PLN-SDV-10_	2023	Chemical & Hazardous Material Management Plan,

			2023
Chemical Management Plan	L2-PLN-HSE-11 R0 Chemical Management Plan.pdf	2023	Chemical Management Plan, 2023
Clan Land Use and Compensation Agreement (Elk & Antelope Infield Road)	AC_21b_Land Use and compensation agreement A0172015	2016	Clan Land Use & Compensation Agreement (Elk & Antelope Infield Road), 2016
Climate Change Risk Assessment Synthesis Report	CCRA Papua LNG Synthesis Report - Final - 20250729	2025	Climate Change Risk Assessment Synthesis Report, 2025
Community Concerns and Grievance Mechanism Procedure	AC_23a_Community Concerns Grievance MechProc_L2-PRO-SDV-02_R2	2023	Grievance Mechanism Procedure, 2023
Community Development Contract for Water, Sanitation and Hygiene Services	SAGO Network – WASH Program Contract.pdf	2024	Community Development Contract for Water, Sanitation & Hygiene Services, 2024
Community Development Health Plan Overview 2025	Gulf Provincial Health Authority MOU background (1)	2025	Community Development Health Plan Overview, 2025
Community Development Management Plan	L2-PLN-SDV-05 R0 Community Development Management Plan.pdf	2024	Community Development Management Plan, 2024
Community Directory Update - Upstream report June 2024 Revision 2	IDP SS_Community Directory Update_Upstream_2024_Rev 2 (2)	2024	Community Directory Rev2, 2024
Community Directory Update Upstream June 2024	Community Directory Update Upstream June 2024	2024	Community Directory Update - Upstream, June 2024
Community Engagement & Resource Mapping - Poroi 2	2025 - 12 - HSSE10 - Community Engagement & Resource Mapping - Poroi 2 - 20250129 - R01	2025	Community Engagement & Resource Mapping - Poroi 2, 2025
Community Engagement & Resource Mapping - Poroi 3 (Suarido) R0	2025 - 13 - HSSE11 - Community Engagement & Resource Mapping - Poroi 3 (Suarido) - 20250129 - R0	2025	Community Engagement & Resource Mapping - Poroi 3 (Suarido) R0, 2025
Community Engagement & Resource Mapping - Ura (TOPO) R01	2025 - 06 - HSSE06 - Community Engagement & Resource Mapping - Ura (TOPO) - 20250117 - R01	2025	Community Engagement & Resource Mapping - Ura (TOPO) R01, 2025

Community Engagement & Resource Mapping - Ura R02	2025 - 11 - HSSE09 - Community Engagement & Resource Mapping - Ura - 20250129 - R02	2025	Community Engagement & Resource Mapping - Ura R02, 2025
Community Engagement & Resource Mapping - Wabo (TOPO) R01	2025 - 05 - HSSE05 - Community Engagement & Resource Mapping - Wabo (TOPO) - 20250117 - R01	2025	Community Engagement & Resource Mapping - Wabo (TOPO) R01, 2025
Community Engagement & Resource Mapping - Wabo R02	2025 - 10 - HSSE08 - Community Engagement & Resource Mapping - Wabo - 20250129 - R02	N/A	Community Engagement & Resource Mapping - Wabo R02, 2025
Community Engagement and Rsource Mapping, Ura Community	Resource Mapping (Ura Community)_20241212	2025	Community Engagement & Resource Mapping - Ura Community, 2025
Community Engagement and Rsource Mapping, Wabo Community	Resource Mapping (Wabo Community)_20241212		Community Engagement & Resource Mapping - Wabo Community, 2025
Community Grievance Brochure	Community Grievance Brochure Eng Rev 4 Aug 2023 MASTER (3)	2023	Grievance Brochure, 2023
Community Grievance Brochure	Community Grievance Brochure	2023	Community Grievance Brochure, 2023
Community Health Officer Job Description	Community Health Officer Job Description.docx	N/A	Community Health Officer Job Description, n.d.
Community Health Safety and Security Management Plan	AC_35_COMMUNITY HSS MP_L2-PLN-SDV-06	2023	Community HSS Management Plan, 2023
Community Health Safety and Security Management Plan	L2-PLN-SDV-06 R0 Community Health, Safety and Security Management Plan.pdf	2023	Community HSS Management Plan, 2023
Community meeting Audio Recording	PRL15 Lida Kibung March 2025 Poroi 2.m4a	2025	Community Meeting Audio Recording, 2025
Conducting Safe Tree Felling Operations	L2-GUI-HSE-01 R0 Tree Felling Operations.pdf	2019	Conducting Safe Tree Felling Operations Procedure, 2019
Construction Environmental and Social Manual (CESM)	CESM REV 0 2025_09_09	2025	Construction Environmental and Social Manual, 2025
CPF and Wellpads - Detailed Risk Assessment (DRA)	PG-P15-30-C022-200035_01_AFU_20231201 (2)	2023	CPF & Wellpads Detailed Risk Assessment (DRA)

Report			Report, 2023
CPF and Wellpads - Environmental Risk Assessment Report (FEED Phase 2 Safety Studies)	PG-P15-30-C022-200017_02_AFU_20231122	2023	CPF & Wellpads ERA (FEED Phase 2 Safety Studies), 2023
CPF and Wellpads - Quantitative Risk Assessment (QRA) Report	PG-P15-30-C022-200036_02_AFU_20231201 (4)	2023	CPF & Wellpads Quantitative Risk Assessment (QRA) Report, 2023
CPF and Wellpads - Technological Risk Assessment (TRA) Action Plan and Risk Register	PG-P15-30-C022-200027_01_AFU_20231204	2023	CPF & Wellpads Technological Risk Assessment (TRA) Action Plan & Risk Register, 2023
Cultural Heritage and Change Finds Procedure	AC_10a_Cultural Heritage & Chance Finds_L2-PRO-SDV-04	2023	Cultural Heritage & Chance Finds Procedure, 2023
Cultural Heritage Management Plan	AC_9a_Cultural Heritage Management Plan_L2-PLN-SDV-07 R0 DATED 20231020	2023	Cultural Heritage Management Plan, 2023
Cultural Heritage Pre-clearance Survey Findings Central Processing Facility (CPF3)	PCS_01215E_90_CPF P3 CH v4FINAL.pdf	2024	Cultural Heritage Pre-Clearance Survey Findings - CPF3, 2024
Cultural Heritage Report Ivo Junction Site Permit #0039	PCS_CH_20240216_Purari River Mission1-Ivo	2024	Purari River Cultural Heritage Report Ivo Junction, 2024
Cultural Heritage Survey and Salvage Procedure	AC_11a_Cultural Heritage Survey and Salvage Proc_L2-PRO-SDV-15	2023	Cultural Heritage Survey & Salvage Procedure, 2023
Derogations Procedure	L2-PRO-HSE-20 R0 Derogations.pdf	2022	Derogations Procedure, 2022
Design highlights for ESDD Ph1	D_ES-design highlights for ESDD Ph1_Final	2023	Design Highlights for ESDD Phase 1, 2023
Design highlights for the ESDD Phase2 – Feb-2025	Design_hglgts_ESDD_P2_Feb2025	2025	ESDD Phase 2 Highlights, 2025
Distribution of Grievance Brochures	20231228_CR_Distribution_of_Grievance_Brochures – Poroi_2_PRL15_2025-06-11	2023	Grievance Brochure Dist., 2023
DRAFT FPIC Agreement Template	FPIC Agreement template draft.pdf	2025	Draft FPIC Agreement Template, 2025

Dredging and Barging Impact Assessment (Purari River), Aug 2025	Purari River Dredging and Barging Impact Assessment (ESIA) (BMT, May-25)	2025	Purari River Dredging & Barging Impact Assessment, 2025
Drilling waste in ESHIA	Drilling waste	2026	ESHIA Drilling Waste, 2026
Drilling waste management	170419_REX TEPPNG Driling Waste Management FINAL 1	N/A	Drilling Waste Management, n.d.
Due Diligence Review of the Elk-Antelope Acid Gas Re-injections (AGR) Plan, PRL 15, PNG as of Dec 2023	AGR DD report_Gafney Cline Apr24	2024	AGR Due Diligence Review, 2024
ECA meeting, GHG ESDD Phase 2, Public Disclosure presentation	extract - _20251119_GHG-ESDDP2	2025	ECA Meeting - GHG ESDD Phase 2 Public Disclosure Presentation, 2025
Ecology Management Plan	L2-PLN-SDV-09 R0 Ecology Management Plan	2023	Ecology Management Plan, 2023
Ecosystem Services Assessment	Ecosystem Services Assessment 2024-07 - 01215E_62_ESA_v2.pdf	2024	Ecosystem Services Assessment, 2024
Ecosystem Services Walk-through for PRL15 FPIC Inventory: Peiho, Jaoho, Nemi na and Sopusa Clans (IDP)	240530_TEP_ESS Walk Through for PRL15 FPIC Inventory_Final	2024	Ecosystem Services FPIC Inventory, 2024
EIS - Volume 1 Chap 01 Introduction	Papua LNG Upstream EIS - Volume 1 Chap 01 Introduction	2019	EIS Vol. 1 Ch. 01 Introduction, 2019
EIS - Volume 1 Chap 03 Impact Assessment Process and Methods	Papua LNG Upstream EIS - Volume 1 Chap 03 Impact Assessment Process and Methods	2019	EIS Vol. 1 Ch. 03 Impact Assessment Process & Methods, 2019
EIS - Volume 1 Chap 04 Project Description	Papua LNG Upstream EIS - Volume 1 Chap 04 Project Description	2019	EIS Vol. 1 Ch. 04 Project Description, 2019
EIS - Volume 1 Chap 05 Project Options and Analysis of Alternatives	Papua LNG Upstream EIS - Volume 1 Chap 05 Project Options and Analysis of Alternatives	2019	EIS Vol. 1 Ch. 05 Project Options & Alternatives Analysis, 2019
EIS - Volume 1 Chap 06 Stakeholder Engagement	Papua LNG Upstream EIS - Volume 1 Chap 06 Stakeholder Engagement	2019	EIS Vol. 1 Ch. 06 Stakeholder Engagement, 2019
EIS - Volume 1 Chap 07 Existing Environment - Terrestrial	Papua LNG Upstream EIS - Volume 1 Chap 07 Existing Environment - Terrestrial	2019	EIS Vol. 1 Ch. 07 Existing Environment - Terrestrial, 2019
EIS - Volume 1 Chap 08 Existing Environment - Marine	Papua LNG Upstream EIS - Volume 1 Chap 08 Existing Environment - Marine	2019	EIS Vol. 1 Ch. 08 Existing Environment - Marine, 2019

EIS - Volume 1 Chap 09 Existing Environment - Social, Economic and Cultural	Papua LNG Upstream EIS_Volume 1_Ch09_Existing Environment - Social, Economic and Cultural	2019	EIS Vol. 1 Ch. 09 Existing Environment - Social, Economic & Cultural, 2019
EIS - Volume 1 Chap 10 Existing Environment - Amenity	Papua LNG Upstream EIS - Volume 1 Chap 10 Existing Environment - Amenity	2019	EIS Vol. 1 Ch. 10 Existing Environment - Amenity, 2019
EIS - Volume 1 Chap 11 Impacts Terrestrial	Papua LNG Upstream EIS - Volume 1 Chap 11 Impacts Terrestrial	2019	EIS Vol. 1 Ch. 11 Impacts Terrestrial, 2019
EIS - Volume 1 Chap 12 Impacts Marine	Papua LNG Upstream EIS - Volume 1 Chap 12 Impacts Marine	2019	EIS Vol. 1 Ch. 12 Impacts Marine, 2019
EIS - Volume 1 Chap 13 Impacts Social	Papua LNG Upstream EIS_Volume 1_Ch13_Impacts Social	2019	EIS Vol. 1 Ch. 13 Impacts Social, 2019
EIS - Volume 1 Chap 14 Impacts Cultural Heritage	Papua LNG Upstream EIS - Volume 1 Chap 14 Impacts Cultural Heritage	2019	EIS Vol. 1 Ch. 14 Impacts Cultural Heritage, 2019
EIS - Volume 1 Chap 15 Impacts Amenity and Climate Change	Papua LNG Upstream EIS - Volume 1 Chap 15 Impacts Amenity and Climate Change	2019	EIS Vol. 1 Ch. 15 Impacts Amenity & Climate Change, 2019
EIS - Volume 1 Chap 16 Impacts Ecosystem Services	Papua LNG Upstream EIS - Volume 1 Chap 16 Impacts Ecosystem Services	2019	EIS Vol. 1 Ch. 16 Impacts Ecosystem Services, 2019
EIS - Volume 1 Chap 17 Cumulative Impacts	Papua LNG Upstream EIS - Volume 1 Chap 17 Cumulative Impacts	2019	EIS Vol. 1 Ch. 17 Cumulative Impacts, 2019
EIS - Volume 1 Chap 18 Major Hazards	Papua LNG Upstream EIS_Volume 1_Ch18_Major Hazards	2019	EIS Vol. 1 Ch. 18 Major Hazards, 2019
EIS - Volume 1 Chap 19 Environmental and Social Management, Monitoring and Reporting	Papua LNG Upstream EIS - Volume 1 Chap 19 Environmental and Social Management, Monitoring and Reporting	2019	EIS Vol. 1 Ch. 19 Environmental & Social Management, Monitoring & Reporting, 2019
EIS - Volume 1 Chap 20 Commitments Register	Papua LNG Upstream EIS - Volume 1 Chap 20 Commitments Register	2019	EIS Vol. 1 Ch. 20 Commitments Register, 2019
EIS - Volume 1 Executive Summary (English)	Papua LNG Upstream EIS - Volume 1 Executive Summary (English)	2019	EIS Vol. 1 Executive Summary, 2019
EIS - Volume 2 - Part 01 Upstream Geology Terrain and Soils Baseline	Papua LNG Upstream EIS - Volume 2 - Part 01 Upstream Geology Terrain and Soils Baseline	2017	EIS Vol. 2 Part 01 Upstream Geology Terrain & Soils Baseline, 2017
EIS - Volume 2 - Part 02 Upstream Hydrology and Meteorology Baseline	Papua LNG Upstream EIS - Volume 2 - Part 02 Upstream Hydrology and Meteorology Baseline	2017	EIS Vol. 2 Part 02 Upstream Hydrology & Meteorology Baseline, 2017

EIS - Volume 2 - Part 03 Upstream Surface Water and Sediment Quality Baseline	Papua LNG Upstream EIS - Volume 2 - Part 03 Upstream Surface Water and Sediment Quality Baseline	2017	EIS Vol. 2 Part 03 Upstream Surface Water & Sediment Quality Baseline, 2017
EIS - Volume 2 - Part 04 Upstream Groundwater Baseline	Papua LNG Upstream EIS - Volume 2 - Part 04 Upstream Groundwater Baseline	2017	EIS Vol. 2 Part 04 Upstream Groundwater Baseline, 2017
EIS - Volume 2 - Part 05 Upstream Freshwater and Estuarine Biodiversity Baseline	Papua LNG Upstream EIS - Volume 2 - Part 05 Upstream Freshwater and Estuarine Biodiversity Baseline	2017	EIS Vol. 2 Part 05 Upstream Freshwater & Estuarine Biodiversity Baseline, 2017
EIS - Volume 2 - Part 06 Upstream Terrestrial Biodiversity Baseline _ Main report	Papua LNG Upstream EIS - Volume 2 - Part 06 Upstream Terrestrial Biodiversity Baseline _ Main report	2017	EIS Vol. 2 Part 06 Upstream Terrestrial Biodiversity Baseline - Main Report, 2017
EIS - Volume 2 - Part 06_ Annex 1a Flora Baseline	Papua LNG Upstream EIS - Volume 2 - Part 06_ Annex 1a Flora Baseline	2019	EIS Vol. 2 Part 06 Annex 1a Flora Baseline, 2019
EIS - Volume 2 - Part 06_ Annex 1c Weeds Baseline	Papua LNG Upstream EIS - Volume 2 - Part 06_ Annex 1c Weeds Baseline	2019	EIS Vol. 2 Part 06 Annex 1c Weeds Baseline, 2019
EIS - Volume 2 - Part 06_ Annex 1d Forestry Baseline	Papua LNG Upstream EIS - Volume 2 - Part 06_ Annex 1d Forestry Baseline	2019	EIS Vol. 2 Part 06 Annex 1d Forestry Baseline, 2019
EIS - Volume 2 - Part 06_ Annex 2 Non Volant Mammals Baseline	Papua LNG Upstream EIS - Volume 2 - Part 06_ Annex 2 Non Volant Mammals Baseline	2019	EIS Vol. 2 Part 06 Annex 2 Non- Volant Mammals Baseline, 2019
EIS - Volume 2 - Part 06_ Annex 3 Bats Baseline	Papua LNG Upstream EIS - Volume 2 - Part 06_ Annex 3 Bats Baseline	2019	EIS Vol. 2 Part 06 Annex 3 Bats Baseline, 2019
EIS - Volume 2 - Part 06_ Annex 4 Avifauna Baseline	Papua LNG Upstream EIS - Volume 2 - Part 06_ Annex 4 Avifauna Baseline	2019	EIS Vol. 2 Part 06 Annex 4 Avifauna Baseline, 2019
EIS - Volume 2 - Part 06_ Annex 5 Herpetofauna Baseline	Papua LNG Upstream EIS - Volume 2 - Part 06_ Annex 5 Herpetofauna Baseline	2019	EIS Vol. 2 Part 06 Annex 5 Herpetofauna Baseline, 2019
EIS - Volume 2 - Part 06_ Annex 6 Dragonflies and Damselflies Baseline	Papua LNG Upstream EIS - Volume 2 - Part 06_ Annex 6 Dragonflies and Damselflies Baseline	2019	EIS Vol. 2 Part 06 Annex 6 Dragonflies & Damselflies Baseline, 2019
EIS - Volume 2 - Part 07 Upstream Deforestation Baseline	Papua LNG Upstream EIS - Volume 2 - Part 07 Upstream Deforestation Baseline	2017	EIS Vol. 2 Part 07 Upstream Deforestation Baseline, 2017
EIS - Volume 2 - Part 08 Upstream Vegetation Regeneration Baseline	Papua LNG Upstream EIS - Volume 2 - Part 08 Upstream Vegetation Regeneration Baseline	2017	EIS Vol. 2 Part 08 Upstream Vegetation Regeneration Baseline, 2017

EIS - Volume 2 - Part 09 Seabed and Coastal Geomorphology Baseline	Papua LNG Upstream EIS - Volume 2 - Part 09 Seabed and Coastal Geomorphology Baseline	2017	EIS Vol. 2 Part 09 Seabed & Coastal Geomorphology Baseline, 2017
EIS - Volume 2 - Part 10 Physical Oceanography Baseline	Papua LNG Upstream EIS - Volume 2 - Part 10 Physical Oceanography Baseline	2017	EIS Vol. 2 Part 10 Physical Oceanography Baseline, 2017
EIS - Volume 2 - Part 11 Marine Water and Sediment Quality Baseline	Papua LNG Upstream EIS - Volume 2 - Part 11 Marine Water and Sediment Quality Baseline	2017	EIS Vol. 2 Part 11 Marine Water & Sediment Quality Baseline, 2017
EIS - Volume 2 - Part 12 Marine Biodiversity Baseline	Papua LNG Upstream EIS - Volume 2 - Part 12 Marine Biodiversity Baseline	2017	EIS Vol. 2 Part 12 Marine Biodiversity Baseline, 2017
EIS - Volume 2 - Part 13 Marine Fisheries and Resources Baseline	Papua LNG Upstream EIS - Volume 2 - Part 13 Marine Fisheries and Resources Baseline	2017	EIS Vol. 2 Part 13 Marine Fisheries & Resources Baseline, 2017
EIS - Volume 2_Part 14_Upstream Community and Demographics Baseline	Papua LNG Upstream EIS - Volume 2_Part 14_Upstream Community and Demographics Baseline	2017	EIS Vol. 2 Part 14 Upstream Community & Demographics Baseline, 2017
EIS - Volume 2_Part 15_Upstream Governance and Economics Baseline	Papua LNG Upstream EIS - Volume 2_Part 15_Upstream Governance and Economics Baseline	2017	EIS Vol. 2 Part 15 Upstream Governance & Economics Baseline, 2017
EIS Addendum Roadshow Comments - Graph Summary	01215E_9_42_EIS Addendum Roadshow Comments_Graphs_v1	n.d ~2024-25	EIS Addendum Roadshow Comments - Graph Summary, ~2024-25
EIS Addendum Roadshow Comments - Register	01215E_9_42_EIS Addendum Roadshow Comments_Register_v1	n.d ~2024-25	EIS Addendum Roadshow Comments - Register, ~2024-25
EIS Adendum Community engagement photo	EIS Poroi 1 (1)	N/A	N/A
EIS Adendum Community engagement photo	EIS Poroi 1 (2)	N/A	N/A
EIS Adendum Community engagement photo	EIS Poroi 1 (3)	N/A	N/A
EIS Adendum Community engagement photo	EIS Poroi 1 (4)	N/A	N/A
EIS Adendum Community engagement photo	EIS Poroi 1 (a)	N/A	N/A
EIS Adendum Community engagement photo	EIS Poroi 1 (b)	N/A	N/A
EIS Adendum Community	EIS Poroi 1 (c)	N/A	N/A

engagement photo			
EIS Adendum Community engagement photo	EIS Poroi 1 (d)	N/A	N/A
EIS Adendum Community engagement photo	EIS Poroi 1 (e)	N/A	N/A
EIS Original Engagement field report	20161207 EIR EIS Road Show - Poroi 1&2	2016	EIS Original Engagement Field Report, 2016
EIS Original Engagement photo	20220409-WA0011	2022	N/A
EIS Original Engagement photo	20220412_103335	2022	N/A
EIS Original Engagement photo	20250404_160634	N/A	N/A
EIS Original Engagement photo	20250404_160729	N/A	N/A
EIS Original Engagement photo	20250404_161831	N/A	N/A
EIS Original Engagement photo	20250404_164103	N/A	N/A
EIS Original Engagement photo	20250404_170218	N/A	N/A
EIS Original Engagement photo	20250404_170235	N/A	N/A
EIS Original Engagement photo	20250404_170914	N/A	N/A
EIS Original Engagement photo	20250404_172608	N/A	N/A
EIS Original Engagement photo	20250404_172623	N/A	N/A
EIS Original Engagement photo	20250404_173102	N/A	N/A
EIS Original Engagement photo	20250404_173154	N/A	N/A
EIS Original Engagement photo	20250404_173436	N/A	N/A
EIS Original Engagement photo	IMG_0026	N/A	N/A

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EIS_Volume 1 Organisation	Papua LNG Upstream EIS_Volume 1 Organisation	N/A	EIS Vol. 1 Organisation, n.d.
EIS_Volume 2_Part 16_Upstream Community Health Baseline	Papua LNG Upstream EIS_Volume 2_Part 16_Upstream Community Health Baseline	2017	EIS Vol. 2 Part 16 Upstream Community Health Baseline, 2017
EIS_Volume 2_Part 17_Upstream Cultural Heritage and Archaeology Baseline	Papua LNG Upstream EIS_Volume 2_Part 17_Upstream Cultural Heritage and Archaeology Baseline	2017	EIS Vol. 2 Part 17 Upstream Cultural Heritage & Archaeology Baseline, 2017
EIS_Volume 2_Part 18_Upstream Land and Natural Resources Baseline	Papua LNG Upstream EIS_Volume 2_Part 18_Upstream Land and Natural Resources Baseline	2017	EIS Vol. 2 Part 18 Upstream Land & Natural Resources Baseline, 2017
EIS_Volume 2_Part 19_Upstream Air Quality Baseline	Papua LNG Upstream EIS_Volume 2_Part 19_Upstream Air Quality Baseline	2017	EIS Vol. 2 Part 19 Upstream Air Quality Baseline, 2017
EIS_Volume 2_Part 20_Upstream Noise Baseline	Papua LNG Upstream EIS_Volume 2_Part 20_Upstream Noise Baseline	2017	EIS Vol. 2 Part 20 Upstream Noise Baseline, 2017
EIS_Volume 2_Part 21_Upstream Landscape and Visual Amenity Baseline	Papua LNG Upstream EIS_Volume 2_Part 21_Upstream Landscape and Visual Amenity Baseline	2017	EIS Vol. 2 Part 21 Upstream Landscape & Visual Amenity Baseline, 2017
EIS_Volume 2_Part 22_Marine and River Traffic and Transport Baseline	Papua LNG Upstream EIS_Volume 2_Part 22_Marine and River Traffic and Transport Baseline	2017	EIS Vol. 2 Part 22 Marine & River Traffic & Transport Baseline, 2017
EIS_Volume 2_Part 23_Field Survey Scope and Methods Documents	Papua LNG Upstream EIS_Volume 2_Part 23_Field Survey Scope and Methods Documents	2016-2017	EIS Vol. 2 Part 23 Field Survey Scope & Methods Documents, 2016-2017
EIS_Volume 3 Organisation	Papua LNG Upstream EIS_Volume 3 Organisation	2019	EIS Vol. 3 Organisation, 2019
EIS_Volume 3_Part1_Underwa ter Noise Modeling for Impact Assessment	Papua LNG Upstream EIS_Volume 3_Part1_Underwater Noise Modeling for Impact Assessment	2019	EIS Vol. 3 Part 1 Underwater Noise Modelling for Impact Assessment, 2019
EIS_Volume 3_Part2_Air Quality Modeling for Impact Assessment	Papua LNG Upstream EIS_Volume 3_Part2_Air Quality Modeling for Impact Assessment	2019	EIS Vol. 3 Part 2 Air Quality Modelling for Impact Assessment, 2019
EIS_Volume 3_Part3_Noise M	Papua LNG	2019	EIS Vol. 3 Part 3 Noise

Modeling for Impact Assessment	Upstream EIS_Volume 3_Part3_Noise Modeling for Impact Assessment		Modelling for Impact Assessment, 2019
EIS_Volume 3_Part4_Marine Modeling for Impact Assessment	Papua LNG Upstream EIS_Volume 3_Part4_Marine Modeling for Impact Assessment	2019	EIS Vol. 3 Part 4 Marine Modelling for Impact Assessment, 2019
EIS_Volume 3_Part5_Greenhouse Gas and Climate Change Impact Assessment	Papua LNG Upstream EIS_Volume 3_Part5_Greenhouse Gas and Climate Change Impact Assessment	2019	EIS Vol. 3 Part 5 GHG & Climate Change Impact Assessment, 2019
Electrical Isolations Procedure	L3-PRO-HSE-03 R0 Electrical Isolations.pdf	2019	Electrical Isolations Procedure, 2019
Environment and Social Pre-Project Report- Appendix 2: List of Applicable Environmental Thresholds	E_20220630_PNG-HSE-800336_ES Pre-Project Report V2_Appendix 2_Applicable Environmental Threshold	2022	Environment & Social Pre-Project Report - Appendix 2 Thresholds, 2022
Environmental and Social Commitment and Action Register (ESCAR) v3	PG-P15-00-PHSE-000023_03_ESCAR	2025	Environmental and Social Commitment and Action Register v3, 2025
Environmental and Social Management System (ESMS)	Papua LNG - ESMS_FINAL	2025	Environmental & Social Management System (ESMS), 2025
Environmental Monitoring, Verification, Audit and Reporting (EMVAR)	L2-PRO-SDV-09 R1 Environmental Monitoring Verification Audit and Reporting Final.docx.pdf	2024	Environmental Monitoring, Verification, Audit & Reporting (EMVAR) Procedure, 2024
ERIAS Studies List	ERIAS Studies list.xlsx	2026	ERIAS Studies List
Erosion and Sediment Control Guideline	L0-GDL-MAN-02 R0 Erosion Sediment Control Guideline.docx	2023	Erosion & Sediment Control Guideline, 2023
ESMS Slides - excerpt from ECA presentation	ESMS_Slides.pptx	2025	ESMS Slides - Excerpt from ECA Presentation, 2025
Evacuations Procedure	L2-PRO-HSE-21 - R0 - Excavations.pdf	2023	Excavations Procedure, 2023
EW&I Construction Lot 1: Invasive Species Implementation Procedure	PG-P15-20-E004-000105_02_AFU_20231215	2023	EW&I Construction Lot 1 Invasive Species Implementation Procedure, 2023
Example Grievances Closed	20240403_Closure_of_Grievance_#_05349_Ruth_Api_AIVAI	2024	Grievance Closed (Ruth Api), 2024
Example Grievances Closed	20240716_CR_Grievance_Closure_Engagement Kav	2024	Grievance Closed (Kavava),

	— ava_PER		2024
Example Grievances Closed	20240903_CR_Consultation_and_Closure_of_Grievance (GR-05979)_Apiope_WW	2024	Grievance Closed (Apiope), 2024
Extract of ESHIA Project Description - well pads and drilling programme detail	extract for ESHIA project description	2026	ESHIA Project Description - Well Pads & Drilling Programme Detail, 2026
FEED Changes Environmental Assessment Report	EAR_v3_01215E_113	2025	FEED Changes Environmental Assessment Reprot, 2025
Field Engagement Report for the Multi-Stakeholder Consultation - 2023	BES SH Consultations Report May 2023.pdf	2023	Field Engagement Report - Multi-Stakeholder Consultation, 2023
File of Regulatory Permits received by Project - dated 2016-2022	B_Permits	2016-2022	File of Regulatory Permits Received by Project (2016-2022), 2016-2022
File of various Social Mapping and Landowner Identification Studies. Includes Clan listings	H_SMLI's	2022	File of Social Mapping & Landowner Identification Studies - Clan Listings, 2022
Fisheries and Livelihoods Assessment of Selected Waterway Communities of the Purari River and Delta	230731_PLNG_IDP Fisheries Livelihoods Assessment of Waterway Communities_Rev 0 (1).pdf	2023	Fisheries & Livelihoods Assessment of Purari River & Delta Communities, 2023
Footprint Reduction Effort Assessment - Pre-design pahse, E&S Multicriteria analysis and Simplified Action Plan	N_20260216_Insuco-Oryx_Footprint Reduction Effort in Papua LNG Project	2023	Footprint Reduction Effort Assessment - Pre-design Phase, 2023
FPIC Verification Technical Memo DRAFT (RINA)	P0047737-2-H1_FPIC Verification Memo_Papua LNG_DRAFT	2025	FPIC Verification Technical Memo (Draft), 2025
Freshwater Critical Habitat Assesment for Papua LNG Project	CHA Freshwater.pdf	2025	Freshwater Critical Habitat Assessment, 2025
Full scale SMLI - Exec Summary	20210318 Papua LNG SMLI FINAL - Executive Summary 2.1 ea	2022	Full Scale SMLI - Executive Summary, 2022
Full scale SMLI Studies - Onshore Pipeline Export Route (Volume 1)	20220821 PER SMLI_Report FINAL 2_ea Volume 1	2022	Full Scale SMLI Studies - Onshore Pipeline Export Route Vol. 1, 2022
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Offshore Pipeline			n.d.
Full scale SMLI studies - Onshore Pipeline Export Route (Volume 2 - Consultation forms)	Onshore PER SMLI Consultation Forms Volume 2-final	2022	Full Scale SMLI Studies - Onshore Pipeline Export Route Vol. 2 Consultation Forms, 2022
Full scale SMLI studies - Onshore Pipeline Export Route (Volume 4 - Clan Membership Listings)	On-shore PER SMLI study_Clan listings_Final Volume 4	2022	Full Scale SMLI Studies - Onshore Pipeline Export Route Vol. 4 Clan Membership Listings, 2022
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Full scale SMLI studies - PRL-15 (Volume 2 - Clan Membership listings)	Papua LNG Landowner identification study for PRL 15_Clan listings_Final	N/A	SMLI PRL-15 Vol. 2 Clan Membership Listings, n.d.
Full scale SMLI studies - PRL-15 (Volume 3 - Consultation Forms)	Papua LNG SMLI PRL15_Volume 3_Final	N/A	SMLI PRL-15 Vol. 3 Consultation Forms, n.d.
Fundamental Principles of Purchasing	Brochure_Fundamental_Principles_of_Purchasing	N/A	N/A
Gender Management Plan	L2-PLN-SDV-08 R0 Gender MP (1)	2023	Gender Management Plan, 2023
Genealogies for Clans on the Onshore Pipeline Export Route - Volume 3	20220523_Final PER Genealogy Volume 3	2022	Genealogies for Clans - Onshore Pipeline Export Route Vol. 3, 2022
Government Security Forces Nationwide Callout Procedure	L2-PRO-SEC-06 - Government Security Forces Nationwide Callout Procedure - 20240515	2024	Government Security Forces Nationwide Callout Procedure, 2025
Health & Safety Management of Contractors Procedure	L2-PRO-HSE-12 - R2 - H&S Management of Contractors.pdf	2025	Health & Safety Management of Contractors Procedure, 2025
Health Plan	L2-PLN-HSE-06 R1 Health Plan.pdf	2024	Health Plan, 2024
Herd Base - PRL15 - Oil Spill Exercise	2024 02 25 - HB - Oil Spill Exercise - JET A1 Storage Tank_DS_ML.pdf	2024	Herd Base PRL-15 Oil Spill Exercise, 2024
Herd Base Community Clinic data 2024	Herd Base Community clinic data past 12 mths	2024	Herd Base Community Clinic Data, 2024
Herd Base Community Clinic data 2024 - Fuel donation	Kobo Fuel Donation_Last 12 months	2024	Herd Base Community Clinic Fuel Donation Data, 2024

Herd Base Community Clinic data 2024 - Gate 2	Kobo_Gate 2 Clinic Data_Last 12 Months	2024	Herd Base Community Clinic Gate 2 Data, 2024
Herd Base Extension: Erosion and Sediment Control Plan	BSE-PLN-001_Herd_Base_Ext_PESCP_Rev00-A	2023	Herd Base Extension Erosion & Sediment Control Plan, 2023
Herd Base Extension: Sensitive Areas Plan	BSE-PLN-002_Herd_Base_Ext_SAP_Rev00	2023	Herd Base Extension Sensitive Areas Plan, 2023
Highlights on Project Design Evolution	extract ppt design highlights_202503	2025	Project Design Evolution Highlights, 2025
Hou Creek Aggregate Dredging Environment Assessment Report	Hou Creek aggregate dredging EAR_v3	2025	Hou Creek Aggregate Dredging Environmental Assessment Report, 2025
Hou Creek Aggregate Dredging Technical Note V4	01215E_M063_Hou Creek_v4.pdf	2026	Hou Creek Technical Note, 2026
HSE Audits and Inspections Procedure	L2-PRO-HSE-11 R1 HSE Audits and Inspections.pdf	2023	Health, Safety and Environment Audits Procedure, 2023
HSE Reporting Procedure	L2-PRO-HSE-06 R1 HSE Reporting.pdf	2024	Health, Safety and Environment Reporting Procedure, 2024
ICP / FPIC Implementation Plan	L2-PLN-SDV-18 - ICP-FPIC Implementation Plan.pdf	2025	ICP / FPIC Implementation Management Plan, 2025
IESC Comments on Preparatory Works MP	230923_Papua-LNG_PrepWorksE&SManagementPlan_Q&A-respTEP	2023	IESC Comments on Preparatory Works Management Plan, 2023
Independent Advisory Panel charter	See web link	N/A	Independent Advisory Panel Charter, n.d.
Independent Peer Review - upstream EIS	IPR Detailed asmt_Stantec May-25 .pdf	2025	Independent Peer Review - Upstream EIS, 2025
Indigenous Peoples Framework (DRAFT R1)	01215E_130_IPP_v7.docx	forthcoming	Indigenous Peoples Framework
Inshore Dolphins Management Procedure	AC_36_Inshore Dolphins Mgmt Proc_L4-PRO-SDV-02	2023	Inshore Dolphins Management Procedure, 2023
International Performance Standards on Environmental and Social Sustainability	International Performance Standards on Environmental and Social Sustainability	2012	International Performance Standards on Environmental and Social Sustainability (2012)
Invasive Species Assessment	Invasive Species Assessment 2025-01 -	2025	Invasive Species

	01215E_61_ISA_v4.pdf		Assessment, 2025
Invasive Species Guideline	L0-GDL-MAN-04 R0 Invasive Species_Guideline.docx	2023	Invasive Species Guideline, 2023
Invasive Species Management Procedure for Preparatory Works	L4-PRO-SDV-08_ Invasive Species Management Procedure	2024	Invasive Species Management Procedure for Preparatory Works, 2024
Investigating Marine Mammal Occurance and Conservation Status in the Purari Delta and Orokolo Bay, and Surrounding Regions: Phase 1 Survey Report	Marine Mammals Study 2024	2024	Marine Mammals Study - Purari Delta & Orokolo Bay Phase 1 Report, 2024
Jaoho MOU	260406 Jaoho MOU Signed.pdf	2026	Jaoho MOU
Komuniti Newsletter Issue 10 English	Komuniti-Newsletter-Toksava-No.10-ENGLISH (2)	2024	Komuniti Newsletter Issue 10 English, 2024
Komuniti Newsletter Issue 10 Tok Pisin	Komuniti-Newsletter-Toksava-No.10_TOK-PISIN	2024	Komuniti Newsletter Issue 10 Tok Pisin, 2024
Komuniti Newsletter Issue 11 English	Komuniti-Newsletter-Toksava-No.11-ENGLISH-FINAL	2024	Komuniti Newsletter Issue 11 English, 2024
Komuniti Newsletter Issue 11 Tok Pisin	Komuniti-Newsletter-Toksava-No.11_TOK-PISIN-FINAL (1)	2024	Komuniti Newsletter Issue 11 Tok Pisin, 2024
Komuniti Newsletter Issue 8 English	Komuniti-Toksava-Issue-8-English (1)	2023	Komuniti Newsletter Issue 8 English, 2023
Komuniti Newsletter Issue 8 Tok Pisin	Komuniti-Toksava-Issue-8-tok-Pisin	2023	Komuniti Newsletter Issue 8 Tok Pisin, 2023
Komuniti Newsletter Issue 9 English	Komuniti-Toksava-Newsletter-No.9-ENGLISH-FINAL-version (1)	2023	Komuniti Newsletter Issue 9 English, 2023
Komuniti Newsletter Issue 9 Tok Pisin	Komuniti-Toksava-Newsletter-No.9-TOK-PISIN-FINAL-version	2023	Komuniti Newsletter Issue 9 Tok Pisin, 2023
L3 (1030) Permit	250909_EP-L3(1030)	2025	L3 (1030) Permit, 2025
Labour and Working Conditions Management Plan	AC_34_LabourWorking_Conditions_MP_L2-PLN-HRA-01_R0	2023	Labour & Working Conditions Management Plan, 2023
LALDP South Draft (Chapter 6)	01215E_127_Ch6_Land Access and Impact Assessment_v2.pdf	Forthcoming	LALDP South

LALDP South Draft (Chapter 7)	01215E_127_Ch7_ICP FPIC and Disclosure_v2.docx	Forthcoming	LALDP South
LALDP South Inforgraphic Domain 1	TEP PNG Social Management System - LALDP South Domain 1_v2.jpg	n.d.	LALDP South
LALDP South Inforgraphic Domain 2	TEP PNG Social Management System - LALDP South Domain 2_v2.jpg	n.d.	LALDP South
LALDP South Inforgraphic Domain 3	TEP PNG Social Management System - LALDP South Domain 4_v2.jpg	n.d.	LALDP South
LALDP South Inforgraphic Domain 4	TEP PNG Social Management System - LALDP South Domain_3_v2.jpg	n.d.	LALDP South
Land Access and Compensation Procedure	L2-PRO-SDV-01 R1 Land Access and Compensation.pdf	2023	Land Access Compensation Procedure, 2023
Land Access and Compensation Procedure	L2-PRO-SDV-01 R1 Land Access and Compensation	2023	Land Access Compensation Procedure, 2023
Land Access Request & Notice of Land Availability Process	L2-PRO-SDV-18 R0 Land Access ILARF and NOLA processes FINAL	2023	Land Access Request & Notice of Land Availability Process, 2023
Land Compensation Claim & Payment Receipt	AC_21d_Land access comp and payment_PRL 037-2023	2023	Land Compensation Claim & Payment Receipt, 2023
Location Map of Poroi 1 Community (satellite image)	2024 - 262 - BSE129 - Community Engagement & Resource Mapping - Poroi 1 (IMG) - 20240710 - R0	2024	Location Map of Poroi 1 Community (Satellite Image), 2024
Location Map of Poroi 2 Community (satellite image)	2024 - 263 - BSE130 - Community Engagement & Resource Mapping - Poroi 2 (IMG) - 20240710 - R0	2024	Location Map of Poroi 2 Community (Satellite Image), 2024
Location Map of Poroi 2 Community (Topo map)	2024 - 262 - BSE129 - Community Engagement & Resource Mapping - Poroi 1 (TOPO) - 20240710 - R0	2024	Location Map of Poroi 1 Community (Topo Map), 2024
Location Map of Poroi 2 Community (Topo map)	2024 - 263 - BSE130 - Community Engagement & Resource Mapping - Poroi 2 (TOPO) - 20240710 - R0	2024	Location Map of Poroi 2 Community (Topo Map), 2024
Management of Downgraded Situations Procedure	L2-PRO-HSE-08 R1 Management of downgraded situation.pdf	2023	Downgraded Situations Management Procedure, 2023
Marine Critical Habitat Assessment for Papua LNG Project	CHA Marine.pdf	2025	Marine Critical Habitat Assessment, 2025
Marine Environmental Baseline Study	Marine EBS 2024.pdf	2024	Marine Environmental Baseline Study, 2024
Marine Safety & Grievance Procedure	20170516_Marine_safety_&_Grievance_procedure_awareness_subu_2_2025-06-11	2017	Marine Grievance Procedure, 2017

Maritime Safety & Grievance Awareness	Maritime_Safety_&_Grievance_Awareness_2025-06-11	2017	Maritime Grievance Awareness, 2017
Market Asses Valuation Assessment Crop Compensation Rates in Project Area of Influence	J-MAVA TEP_PLNG_IDP_T2-5_0001 Market Asset Valuation Assessment 2022_Rev 1	2022	Market Asset Valuation Assessment - Crop Compensation Rates in Project Area of Influence, 2022
MedEvac Management of Medical Emergencies Procedure	L2-PRO-HSE-02 Medevac.pdf	2025	MedEvac Management of Medical Emergencies Procedure, 2025
Medical Support to Local Communities October 2023 report	Medical Support to Local Communities - October Report (1)	2023	Medical Support to Local Communities October 2023 Report, 2023
Medical Support to Local Communities Procedure	L4-PRO-HSE-01 Medical Support to Local Communities (7)	2023	Medical Support to Local Communities Procedure, 2023
Meeting Minutes: 2nd PER/ WW Komuniti Lidas Kibung #2-2025	2025306- 10th Lida Kibung Meeting Minutes-Kavava_PER.pdf	2025	Meeting Minutes - 2nd PER/ WW Komuniti Lidas Kibung #2-2025, 2025
Meeting minutes: PRL 15 Komuniti Lisa Kibung #9	20250307 _ 9th PRL15 Komuniti Lida Kibung Meeting Minute_Poroi 2.pdf	2025	Meeting Minutes - PRL15 Komuniti Lisa Kibung #9, 2025
Memo: Upstream CPF Site Relocation – Location Screening Project & Construction Impacts	AI_3 Memo basis for P3 decision_PG-P15-30-PMGT-MEM-000211	2023	Memo: Upstream CPF Site Relocation – Location Screening Project & Construction Impacts, 2023
Messaging on Grievance Procedures	20231226_CR_Brief_messaging_on_Grievance_Procedures_Evara_WWPER_2025-06-11	2023	Grievance Messaging, 2023
MoM of FSO discussion and presentations with Rina, 23.01.2024	MOM 250123 Interim#8_FSO	2024	MoM of FSO Discussion & Presentations with Rina, 2024
MOU Gulf Christian Services	MOU Gulf Christian Services.pdf	N/A	MOU Gulf Christian Services, n.d.
MoU with Government Forces Snapshot	MoU with Government Forces snapshot.png	N/A	N/A
Multi-stakeholder Consultation Report March 2023	BES SH Consultations Report March 2023.pdf	2023	Multi-Stakeholder Consultation Report, 2023

National Content	Contract Management National Content exhibit M	2025	National Content, 2025
Net Gain Feasibility Study (Earth Active)	Papua LNG Net Gain Feasibility Study	2025	Net Gain Feasibility Study (Earth Active), 2025
Noise and Vibration Management Plan	L2-PLN-SDV-15 Noise and Vibration MP	2024	Noise & Vibration Management Plan, 2024
Offshore Pipeline Systems and Offshore FOC - Third-Party Interaction and Quantitative Risk Assessment	PG-P15-50-O001-255106_04_AFD_20250424	2025	Offshore Pipeline Systems & FOC QRA, 2025
Oil Spill Response Plan (OSRP)	Files of L2-PLN-HSE-03 in folder: 20260202_PRL 15 OSRP	2017	Oil Spill Response Plan, 2016
Onshore Pipelines - Quantitative Risk Analysis Report	PG-P15-40-O001-125104_04_AFD_20250530 (1)	2025	Onshore Pipelines QRA, 2025
Onsite Grievance Committee Minutes of Meeting	20240323 L2-PRO-SDV-02 CCGMP OGC Meeting Minutes	2024	Onsite Grievance Committee Minutes of Meeting, 2024
Orchids and Sensitive Plants Management Procedure	L4-PRO-SDV-07 R0 Orchids and Sensitive Flora Management Procedure.docx(1)	2023	Orchids & Sensitive Plants Management Procedure, 2023
Orokolo Bay Nearshore Crossing Methodology 2025 - Technical note	PS5-11 PS6-27_ PG-P15-50-PHSE_000001_OrokoloBayMemo2025	2025	Orokolo Bay Nearshore Crossing Methodology - Technical Note, 2025
Overarching Vegetation Clearing Procedure	L2-PRO-SDV-17 R0 Overarching Clearing Procedure	2023	Overarching Vegetation Clearing Procedure, 2023
PAOI Events Catalogue	Events Catalogue- SnapShot	2017-2026	N/A
Papua LNG Remote Sensing Needs	Q_1_Remote Sensing monitoring_SOW 20230211	2023	Remote Sensing Needs, 2023
Papua LNG project EIA: TotalEnergies SE - DG/STS/HSE/GCA/SUP input about Oil spill Management, December 2025	papuaLNG draft_spill_management_chapter_for ESI A_oct2025.docx	2025	Oil Spill Management Input (unpublished), 2025
Pathways to a Sustainable Future, Total Energies PNG, Sustainability Report 2015-2022	230823_Sustainability-Report_2015-2022	2022	Pathways to a Sustainable Future - Total Energies PNG Sustainability Report 2015-2022, 2022

PCS Project: Erias Mobilisation 9 Debrief	O_9a PCS Highlights_CPF new location	2023	Pre-Clearance Survey Project - Erias Mobilisation 9 Debrief, 2023
Permit to Work Procedure	L2-PRO-HSE-03 R0 Permit to Work	2023	Permit to Work Procedure, 2023
Permit to Work Procedure	L2-PRO-HSE-03 Permit to Work.pdf	2018	Permit to Work Procedure, 2018
Permitting Register	TEP_PNG_Master_ENV_Permitting_Register_20251224	2025	Permitting Register, 2025
Permitting Status Overview	20250527_Permitting Status Overview	N/A	Permitting Status Overview, 2025
Personal Protective Equipment 'PPE' Procedure	L2-PRO-HSE-14 R0 PPE.pdf	2019	Personal Protective Equipment 'PPE' Procedure, 2019
Phase 1 - Rehabilitation_Plan	AC 32a_L2-PRO-SDV-12_Phase1_Rehabilitation_Plan	2023	Phase 1 Rehabilitation Plan, 2023
Photo of Grievance Documentation Work	Grievance documentation photo 1	N/A	N/A
Photo of Grievance Documentation Work	Grievance documentation photo 2	N/A	N/A
Photo of Grievance Documentation Work	Grievance documentation photo 3	N/A	N/A
Photo of Grievance Documentation Work	Grievance documentation photo 4	N/A	N/A
Photo of VLO training taking place	VLO training photo 1	2024	N/A
Photo of VLO training taking place	VLO training photo 2	2024	N/A
Photo of VLO training taking place	VLO training photo 3	2024	N/A
PIIM Situation Assessment of Proposed Information Hubs and Wabo Station: Baimuru Summary Report	754-MELEN292540_7_PIIM_Assessment_Report_BAIMURU_Rev0	2024	PIIM Situation Assessment - Baimuru Summary Report, 2024
PIIM Situation Assessment of Proposed Information Hubs and Wabo Station: Ihu Summary Report	754-MELEN292540_7_PIIM_Assessment_Report_IHU_Rev0	2024	PIIM Situation Assessment - Ihu Summary Report, 2024

PIIM Situation Assessment of Proposed Information Hubs and Wabo Station: Kerema Summary Report	754-MELEN292540_7_PIIM_Assessment_Report_KEREMA_Rev0	2024	Project Induced In Migration Situation Assessment - Kerema Summary Report, 2024
PIIM Situation Assessment of Proposed Information Hubs and Wabo Station: Kikori Summary Report	754-MELEN292540.7_PIIM_Assessment_Report_Kikori_Rev0	2024	PIIM Situation Assessment - Kikori Summary Report, 2024
PIIM Situation Assessment of Proposed Information Hubs and Wabo Station: Wabo Summary Report	754-MELEN292540.7_PIIM_Assessment_Report_WABO_Rev0	2024	PIIM Situation Assessment - Wabo Summary Report, 2024
Pipeline Risk Assessment SSIV Requirement Report	PG-P15-52-O001-125101_02_AFD_20250520	2025	Pipeline SSIV Risk Assessment Report, 2025
Pipeline Systems - Offshore Environmental Risk Assessment	PG-P15-50-O001-125111_03_AFD_20250522	2025	Pipeline Systems Offshore ERA, 2025
Pipeline Systems - Onshore Environmental Risk Assessment	PG-P15-40-O001-125117_03_AFD_20250522	2025	Pipeline Systems Onshore ERA, 2025
Pokore Hamlet - Result from PIIM Survey	Pokore - Result from PIIM Survey.pdf	2024	Pokore PIIM Survey Results, 2024
Pre-Clearance Survey Findings - Camp 2	PCS_01215E_67_Camp 2_v4.pdf	2023	Pre-Clearance Survey Findings - Camp 2, 2023
Pre-Clearance Survey Findings - Camp 3	PCS_01215E_70_Camp 3 v2.pdf	2023	Pre-Clearance Survey Findings - Camp 3, 2023
Pre-Clearance Survey Findings - Central Processing Facility	PCS_01215E_77_CPF P3_v7.pdf	2025	Pre-Clearance Survey Findings - CPF P3, 2025
Pre-Clearance Survey Findings - Cultural heritage - Preparatory Works Areas	O5b_2022_Pre Works_PCS_FINAL	2022	Pre-Clearance Survey Findings - Cultural Heritage Preparatory Works Areas, 2022
Pre-clearance Survey Findings - Herd Base Expansion	O4b_01215E_34_Herd Base PCS_Results_v4	2023	Pre-Clearance Survey Findings - Herd Base Expansion, 2023
Pre-clearance Survey Findings - Quarry C & D	PCS_01215E_13_QuarryC&D_v3.pdf	2024	Pre-Clearance Survey Findings - Quarry C & D, 2024

Pre-Clearance Survey Findings - Road R03 and Spoil Disposal Area R03-01	PCS_01215E_55_R03_v7.pdf	2024	Pre-Clearance Survey Findings - Road R03 & Spoil Disposal R03-01, 2024
Pre-Clearance Survey Findings - Road R03 and Spoil Disposal Area R03-01	O_8a_01215E_55_PCS_R03_v5	2023	Pre-Clearance Survey Findings - Road R03 & Spoil Disposal R03-01, 2023
Pre-clearance Survey Findings - Road R05 (North) (Chainage 9,300 to 27,500)	O_7c_01215E_59_R05 North_v5	2023	Pre-Clearance Survey Findings - Road R05 North, 2023
Pre-clearance Survey Findings - Road R05 (South) (Chainage 0 to 9,300)	PCS_01215E_43_R05_v11.pdf	2024	Pre-Clearance Survey Findings - Road R05 South, 2024
Pre-clearance Survey Findings Comparison - CPF P2 and CPF P3	PCS Findings Comparison CPF P2-P3_V4	2024	Pre-Clearance Survey CPF Comparison, 2024
Pre-Clearance Survey Report - Cultural heritage - CPF, Associated Facilities and Herd Base Expansion	O5a_2022_CPF-HBExtension_PCS_FINAL (1)	2022	Pre-Clearance Survey Report - Cultural Heritage CPF & Herd Base Expansion, 2022
Pre-clearance Survey Report - Cultural Heritage - Mobilisations 4 & 5	O5c_2023_Trunkline_CH_PCS_FINAL	2023	Pre-Clearance Survey Report - Cultural Heritage Mobilisations 4 & 5, 2023
Pre-Clearance Survey Report Status March 2025	PCS report status March 2025	2025	PCS Report Status March 2025, 2025
Pre-Clearance Surveys - Focused Maps	2024 - 274 - BSE135 - Environmental and Cultural Heritage Pre-Clearance Surveys - Focused - 20240816 - R0	2024	Pre-Clearance Surveys Focused Maps, 2024
Pre-Clearance Surveys - Herd Base Expansion - Context and Methods	O4a_01215E_33_PCS_HerdBase_ContextMethods_v4	2022	Pre-Clearance Surveys - Herd Base Expansion Context & Methods, 2022
Pre-Clearance Surveys - Overview Maps	2024 - 273 - BSE134 - Environmental and Cultural Heritage Pre-Clearance Surveys - Overview - 20240816 - R0	2024	Pre-Clearance Surveys Overview Maps, 2024
Pre-Clearance Surveys - Preparatory Works Area - Context and Methods	O6a_01215E_17_PCS-Context and Method	2023	Pre-Clearance Surveys - Preparatory Works Area Context & Methods, 2023
Pre-Clearing Procedure and Clearing Procedure	L2-PRO-SDV-16 R0 PreclearingClearingProcedure	2023	Pre-Clearing Procedure & Clearing Procedure, 2023
Pre-Construction Survey Report: Offshore Pipeline	KPS FSO PCS_ERIAS 2025	2025	Pre-Construction Survey Report - Offshore Pipeline,

			2025
Preparatory Works Environmental and Social Management Plan - Activities under EP-L2(682)	PG-P15-00-PHSE-000059_01_PREPARATORY WORKS ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN_ACTIVITIES UNDER	2023	Preparatory Works Environmental & Social Management Plan (EP-L2), 2023
PRL 15 EIS Addendum Roadshow Q&A	PRL 15 EIS Addendum roadshow memo - FINAL	2025	PRL 15 EIS Addendum Roadshow Q&A, 2025
Project Camp Standards and Working Conditions	PG-P15-00-PHSE-000065_01_AFU_20240726.pdf	2024	Project Camp Standards & Working Conditions, 2024
Project Health Management Procedure	PG-P15-00-PHSE-000009_00_AFU_2023-03-24_02 PROJECT HEALTH MANAGEMENT PLAN.pdf	2023	Project Health Management Procedure, 2023
Project Induced In Migration Local Survey	PIIM_survey_-_In-migrantnon-local_survey_-_ _all_versions_-_labels_-_2025-06-18-00-58-27.xlsx	2025	Project-Induced In- Migration Local Survey, 2025
Project Induced In- migration Head of Household Survey data	PIIM_-_Head_of_Household_Survey_-_all_versions_-_ _labels_-_2025-06-18-00-58-11.xlsx	2025	Project-Induced In- Migration Head of Household Survey Data, 2025
Project Induced In-migration Household baseline	PIIM_-_household_baseline_in_hotspot_locations_fill_this_ out_for_each_household_member_-_all_versions_-_ _labels_-_2025-06-18-00-58-39.xlsx	2025	Project Induced In- Migration Household Baseline, 2025
Project Induced In-Migration Management Plan	L2-PLN-SDV-17 R0 Project-Induced in-Migration Management Plan.pdf	2023	Project Induced In- Migration Management Plan, 2023
Project Induced In-Migration Management Procedure	PIIMMP_PG-P15-00-PHSE-000052	2023	Project-Induced In- Migration Management Procedure, 2023
Project Induced In-Migration Situation Assessment of Proposed Information Hubs and Wabo Station	754-MELEN292540.7_Assessment Report_Rev0	2024	Project-Induced In- Migration Situation Assessment, 2024
Project Industrial Action Management Procedure	PG-P15-00-PHSE-000078_00_Industrial Action Management Procedure.pdf	2025	Project Industrial Action Management Procedure, 2025
Project Industrial Relations Monitoring Policy and Procedure	PG-P15-00-PHSE-000066_01_AFU_20240725.pdf	2024	Project Industrial Relations Monitoring Policy & Procedure, 2024
Project Labour and Working Conditions Management	PG-P15-00-PHSE-	2025	Project Labour & Working Conditions Management

Procedure	000044_01_Project_Labour_and_Working_Condition s_management_procedure.pdf		Procedure, 2025
Project Land Access and Livelihoods Framework Plan	L2-PLN-SDV-13 R0 Project Land Access and Livelihood Framework.pdf	2023	Project Land Access & Livelihoods Framework Management Plan, 2023
Project Raw Materials Management Procedure	PG-P15-00-PHSE-000035_01.pdf	2026	Project Raw Materials Management Procedure, 2026
Project Recruitment Policy and Procedure	PG-P15-00-PHSE-000061_01_AFU_20240729.pdf	2024	Project Recruitment Policy & Procedure, 2024
Project Soil Management Procedure	PG-P15-00-PHSE-000036_00_AFU_2023-09-14_02_SoilManagement	2023	Project Soil Management Procedure, 2023
Project Soil Management Procedure	PG-P15-00-PHSE-000036_01	2026	Project Soil Management Procedure, 2026
Project Workforce Complaints and Grievance Procedure	PG-P15-00-PHSE-000063_01_AFU_20240731.pdf	2024	Project Workforce Complaints & Grievance Procedure, 2024
Project Workforce Demobilisation procedure	PG-P15-00-PHSE-000064_01_AFU_20240725.pdf	2024	Project Workforce Demobilisation Procedure, 2024
Project Workforce Disciplinary Procedure	PG-P15-00-PHSE-000062_01_AFU_20240726.pdf	2024	Project Workforce Disciplinary Procedure, 2024
Provision of Fisheries Baseline Study Services: Technical Proposal	SCOPE OF WORK Fishery Study - 01215E_P44_TechnicalProposal_v3.pdf	N/A	Provision of Fisheries Baseline Study Services: Technical Proposal, n.d.
Provision of Security Services (PRL-15) - snapshot	Contractual Training requirements - Service Provider.png	N/A	N/A
PS2 and PS4 Gap Assessment Report	IDP_TEP-T6_PS2 and PS4 Gap Assessment Report_Rev 0	2022	PS Gap Assesment, 2022
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Purari River Cultural Heritage Survey Findings - Mission 2	PCS_CH_01215E_110_CH_Purari River Mission2	2025	Purari River Cultural Heritage Survey Findings - Mission 2, 2025
Purari River Cultural Heritage Survey Findings - Mission 3	PCS_CH_01215E_115_Purari River Mission 3	2025	Purari River Cultural Heritage Survey Findings - Mission 3, 2025

Quarantine Management Procedure	L2-PRO-SDV-08 R0 Quarantine Mangement Procedure	2024	Quarantine Management Procedure, 2024
Quarry Alternatives Assessment Report (Erias, V3)	AAA Quarries.pdf	2025	Quarry Alternatives Assessment Report (Erias, V3), 2025
Quarry Options for North Purari Conservation Requirements - Decision Note	QuarryOptions_Decision note_PG-P15-20-PHSE-000002.pdf	2025	Quarry Options for North Purari Conservation Requirements - Decision Note, 2025
Ramboll Gap Analysis	FRTOTGU002-R1V.1 - Gap Analysis Papua LNG Project against IFC PS and Guidelines_compiled	2022	Ramboll Gap Analysis, 2022
Raw Materials Management Plan	L2-PLN-SDV-20 R0 Raw Materials Management Plan	2023	Raw Materials Management Plan, 2023
Raw Materials Management Procedure	L4-PRO-SDV-06 R0 Raw Materials Management Procedure for Preparatory Works	2023	Raw Materials Management Procedure for Preparatory Works, 2023
Rehabilitation of Drill Pads and Helipads at Aure Scarp	AC_32c_Memo_AureScarp_Rehabilitation_Report 20231013	2023	Rehabilitation of Drill Pads & Helipads at Aure Scarp, 2023
Remote Sensing Assessment, Anthropogenic Impact on Forest Evolution	Q_RSS_Memo_Papua_LNG_Env_study_UpstreamArea	2023	Remote Sensing Assessment - Anthropogenic Impact on Forest Evolution, 2023
Reporting and Analysis of HSE Events Procedure	L2-PRO-HSE-06 R0 Reporting and Analysis of HSE Events	2019	Reporting & Analysis of Health, Safety, Environment Events Procedure, 2019
Residual Impact Assessment (RIA) (Earth Active, 2025)	Papua LNG Residual Impact Assessment	2025	Residual Impact Assessment, 2025
Response for Pre-Draft ESAP PS3-9: Side casting	Sidecasting memo_June2025.pdf	2025	Side Casting Response Memo, 2025
Response to Gaffney Cline & Associates Acid Gas Re-injection Due Dilligence Recommendations	Response memo AGRU Due Diligence.pdf	2025	Acid Gas Re-injection Due Diligence Response, 2025
Rina ESDD Phase 2 Report	P0047563-H1-Papua LNG Phase II ESDD 2nd Draft	2025	Rina ESDD Phase 2 Report, 2025
Risk Assessment Procedure	L2-PRO-HSE-10 R2 Risk Assessment.pdf	2024	Risk Assessment Procedure, 2024
River Traffic Best Practices	Support Marine Brochure	N/A	River Traffic Best Practices Brochure, n.d.

River Traffic Management Plan	L2-PLN-MAR-01 R1 River Traffic Management Plan.pdf	2023	River Traffic Management Plan, 2023
River Traffic Management Procedure	L2-PRO-MAR-02 R1 River Traffic Management Procedure.pdf	2023	River Traffic Management Procedure, 2023
Riverway Best Practice Brochure	Marine Community Brochure	2024	Riverway Best Practice Brochure, 2024
Security Incident Report Template	Security Incident Report Rev.03	N/A	Security Incident Report Template, n.d
Security Risk Assessment - Field Missions (Template)	014. Security Risk Assessment- Field Operations Rev.04 (2) (1)	N/A	Security Risk Assessment - Field Missions (Template), n.d
SEQUANA Qualification: Verification rules applied to Questionnaires	C&P Due diligence process SEQUANA Questionnaires.pdf	2024	SEQUANA Questionnaire Verification Rules, 2024
Service Provider Contractual Requirements- snapshot	Service Provider Contractual requirements	N/A	N/A
Service Provider Contractual Requirements- snapshot (2)	Service Providers Contractual Requirements 2	N/A	N/A
Short Term Lease Extension Letter to Nemina Clan	AC_21c_STL Extension Letter_Nemina_20230824	2023	Short Term Lease Extension Letter to Nemina Clan, 2023
Site Restoration and Rehabilitation Management Plan	L2-PLN-SDV-21 Site Restoration and Rehabilitation MP	2024	Site Restoration & Rehabilitation Management Plan, 2024
Soil Management Plan	AC 30b_L2-PLN-SDV-22_Soil Management Plan.docx	2023	Soil Management Plan, 2023
Staffing Plan	Extract for staffing numbers	N/A	Staffing Plan (unpublished), n.d.
Stakeholder Engagement Management Plan	AC_22a_Stakeholder Engagement MP_L2-PLN-SDV-24 R0	2023	Stakeholder Engagement Management Plan, 2023
Summary of Critical Habitat Assessments (Earth Active)	Papua LNG CHA Summary	2025	Critical Habitat Assessments Summary, 2025
Support to Communities: Donation of Hydrocarbon Product Procedure	L2-PRO-SDV-10 R0 Support to communities donation of HC product.docx (4)	2024	Support to Communities - Donation of Hydrocarbon Product Procedure, 2024
Surface and Groundwater Management Plan	AC 5b_L2-PLN-SDV-25_Surface and Groundwater Plan.docx	2023	Surface & Groundwater Management Plan, 2023

Technical Note: Relocation of Upstream CPF & related facilities near and at Herd Base	AI_2 Tech note CPF Relocation_PG-P15-30-PARC-000002_Rev 01	2023	CPF Relocation Tech Note, 2023
Template - Appendices: Health, Safety, Social (Local Community), Security and Environment Requirements	Contract Management HSSSE exhibit L_Appendices.docx	N/A	Template - Health Safety, Social, Security Requirements Appendices, n.d.
Template - Health, Safety, Social (Local Community), Security and Environment Requirements	Contract Management HSSSE exhibit L.docx	N/A	Template - Health, Safety, Social, Security Requirements, n.d.
Terrestrial Fauna Management Procedure	L4-PRO-SDV-01 R0 Terrestrial Fauna_Management Procedure.docx(1)	2023	Terrestrial Fauna Management Procedure, 2023
Traffic and Transport Management Plan	L2-PLN-SDV-26 R0 Traffic & Transport Management Plan.pdf	2023	Traffic & Transport Management Plan, 2023
Trial Barge Operation, 1-16 May 2023, Social & Community Observations and Recommendations	230523 IDP_Trial Barge Social & Community Obs & Rev 0.docx	2023	Trial Barge Operation - Social & Community Observations & Recommendations, 2023
Upstream Baseline Noise Survey	2025_Upstream Baseline Noise Survey_FINAL	2026	Upstream Baseline Noise Survey, 2026
Upstream Community Health Baseline Report (DUPLICATE of EIS chapter)	Health Baseline Erias 2017 v6.pdf	2017	Upstream Community Health Baseline Report, 2017
Upstream EIS PRL-15 Addendum: Main Report and Appendices	Papua_LNG_PRL15_EIS_Addendum_November_2024	2024	Upstream EIS PRL-15 Addendum: Main Report & Appendices, 2024
Upstream Environmental Impact Statement	n/a - see individual chapter files. Vol 1-3	2019	Upstream Environmental Impact Statement, 2019
Upstream Human Rights Impact Assessment Summary + cover note	HRIA review cover note and Papua LNG Upstream HRIA_Summary_Rev1 04 July 2025	2025	Upstream Human Rights Impact Assessment Summary & Cover Note, 2025
Upstream Sustainability Report 2023	Papua-LNG-Upstream-Sustainability-Report-2023 - PRINT	2023	Upstream Sustainability Report, 2023
Upstream Terrestrial Critical and Natural Habitat Assessment (Erias)	ERIAS_Jul 2025_TCHNA report (01215A_44_CNHA Report_v4).pdf	2025	Terrestrial Critical & Natural Habitat Assessment (Erias), 2025

Village Liaison Officers Presentation	Upstream VLO presentation_DRAFT	N/A	Village Liaison Officers Presentation, n.d.
VLO Onboarding & Inductions PPT (Community Relations)	04_VLO Onboarding & Induction_Training CR	2024	VLO Onboarding & Induction Training (Community Relations), 2024
Voluntary Principles on Security and Human Rights Implementation Guide	L2-GUI-SEC-03 - VPSHR Implementation.pdf	2018	VPSHR Implementation Guide, 2018
Voluntary Principles on Security and Human Rights Policy	L1-POL-MAN-06 - VPSHR Policy - R1 - 20240819 (1)	2024	Voluntary Principles on Security and Human Rights Policy. 2024
Voluntary Principles on Security and Human Rights Procedure	L2-PRO-SEC-03 - VPSHR PROCEDURE - R0 - 20240819 (1)	2024	Voluntary Principles on Security and Human Rights Procedure, 2024
Waste Management Plan	L2-PLN-HSE-07 R2 Waste Management Plan	2024	Waste Management Plan, 2024
Waste Management Procedure	PG-P15-00-PHSE-000032_00_AFU_2023-07-25_01_WasteManagementPro.pdf	2023	Waste Management Procedure, 2023
Water Management Guideline	L0-GDL-MAN-03 R0 Water Management Guideline.docx	2023	Water Management Guideline, 2023
Wildlife Management Guideline	L0-GDL-MAN-05_Wildlife Management Guideline.docx	2023	Wildlife Management Guideline, 2023
Work at Height Procedure	L2-PRO-HSE-15 R0 Work at Height.pdf	2024	Work at Height Procedure, 2024
FPIC meeting minutes Jaoho MOU Signing	20260406_FPIC MOU Signing Jaoho_Meeting Minutes_Wabo .pdf	2026	Jaoho MOU Signing Meeting Minutes
Hou Creek Aggregate Extraction - Communications Pack	260405 Hou Creek Comms Pack.docx	2026	Hou Creek Aggregate Communications
FPIC Evidence Log - Jaoho agreement	FPIC Evidence Log (JAOHO Example).pdf	nd	FPIC Evidence Log – Jaoho
FPIC MOU Status - as of 22.07.26	FPIC MoU Status.docx	2026	FPIC MOU Status
FPIC Status Register - Jaoho	FPIC Status Register (JAOHO Example) Jun 2026.pdf	2026	FPIC Status Register - Jaoho
Community Security Risk Assessment (DRAFT)	Community Security Risk Assessment.docx	nd	Community Security Risk Assessment
Community Health, Safety and Security Management Plan Rev0-C (DRAFT)	L2-PLN-SDV-06 RO Community Health Safety & Security Management Plan_IDP Rev 0-C.docx	forthcoming	Community Health and Safety Security

			Management Plan (forthcoming)
Community Grievance Procedure (R3)	L2-PRO-SDV-02 R3 Community Grievance Procedure CLEAN.docx	2026	Community Grievance Procedure, 2026
Societal Photos - various images	Societal Photos	nd	n/a
Aggregate Sourcing Memo	01215E_M065_Aggregate_Sourcing_v2_TEP Comments.docx	2026	Aggregate Sourcing Memo, 2026

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