



Papua New Guinea LNG Project

Independent Environmental and Social Consultant

IESC - PNG LNG Desktop Monitoring - Final Report

Doc. No. P0022407-3-H1 Rev. 0 - 27 May 2022

Rev.	Description	Prepared by	Controlled by	Approved by	Date
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ABBREVIATIONS AND ACRONYMS

AA	Assessment Area
ADR	Alternative Dispute Resolution
ALS	Alternative Livelihood Strategy
ASL	Above Sea Level
bbl	Barrel
BIMP	Biodiversity Implementation and Monitoring Program
BRC	(New Guinea) Binatang Research Centre
BS	Biodiversity Strategy
CBD	Convention on Biological Diversity
CDS	Community Development Support
CEPA	Conservation and Environment Protection Authority
CEXIM	Export-Import Bank of China
CP	Cathodic Protection
CTA	Common Terms Agreement
CV	Check valves
E&S	Environmental and Social
EC	Enterprise Centre
ECA	Export Credit Agency
ECCP	Enhancing Conservation Capacity Program
ECI	Environmental Compliance Incident
EHS	Environmental Health & Safety
EIS	Environmental Impact Statement
EM	ExxonMobil
EMP	Environmental Management Plan
EMPNG	ExxonMobil PNG Limited (formerly EHL – Esso Highlands Limited)
ESC	Erosion and Sediment Control
ESMP	Environment and Social Management Plan
ESMS	Environmental and Social Management System
ESRP	Erosion, Sediment, Reinstatement Plan
GBIF	Global Biodiversity Information Facility
H&S	Health and Safety
HGCP	Hides Gas Conditioning Plant
HWMF	Hides Waste Management Facility
IESC	Independent Environmental and Social Consultant
IFC	International Finance Corporation
ISOS	International SOS
JBIC	Japan Bank for International Cooperation
Km	Kilometer
KP	Kilometer Point
KPA	Kumul Petroleum Academy
L&CA	Land and Community Affairs
LI	Linear Infrastructure
LKRUMP	Lower Kikori Resource Use Management Plan
LNG	Liquefied Natural Gas
LOBID	Landowner Beneficiaries Identification

LTI	Lost Time Incident
M&E	Monitoring and Evaluation
MLV	Main Line Valves
MOC	Management of Change
MOH	Medicine and Occupational Health
MOU	Memorandum of Understanding
MTA	Million tons per annum
NAQIA	National Agriculture Quarantine and Inspection Authority
NBSAP	National Biodiversity Strategy and Action Plan
NC	Non-Conformance or Non-Compliance
NCCC	National Content Coordination
NEXI	Nippon Export and Investment Insurance
NGO	Non-Governmental Organization
NMAG	National Museum & Art Gallery
NNL	No Net Loss
O&M	Operation and Maintenance
OIMS	Operations Integrity Management System
OSL	Oil Search Limited
P1, P2, etc.	Priority 1 weed, Priority 2 weed, etc.
PCS	Pre-Construction Survey
PDL	Petroleum Development License
PMA	Program Monitoring Activity
PNG LNG	Papua New Guinea Liquefied Natural Gas Project
PS	Performance Standard
Q	Quarter
RAP	Resettlement Action Plan
RoW	Right-of-Way
SACE	Servizi Assicurativi del Commercio Estero
SCICC	Strategic Community Investment Coordination Committee
STP	Sewage Treatment Plant
TOR	Terms of Reference
TRIR	Total Recordable Incident Rate
TRM	Turf Reinforced Matting
TSS	Total suspended solids
TWM	Total Waste Management
UA	Upstream Area
U-PNG	University of PNG
USEXIM	Export-Import Bank of the United States
VMP	Vehicle Monitoring Plan
WCS	Wildlife Conservation Society
WMA	Wildlife Management Area
WMZ	Weed Management Zone

EXECUTIVE SUMMARY

This report represents the 21st post-financial close review of the Papua New Guinea Liquefied Natural Gas (PNG LNG) Project with ExxonMobil PNG Limited (EMPNG) as the Operator made by Rina Consulting S.p.A. of Genoa, Italy serving in the role of the Independent Environmental and Social Consultant (IESC) on behalf of Export Credit Agencies (ECAs) and Commercial Banks providing Project financing (Lenders). The purpose of this review has been to evaluate conformance with Project environmental and social commitments made for the Production phase of this development. This report is now the third consecutive desktop review based on information provided by EMPNG without undertaking a field visit as various international restrictions imposed by the Papua New Guinean Ministry for Immigration and Border Security and uncertainties related to the outbreak of the Coronavirus (COVID-19) again prevented the IESC from visiting the Project. The review was therefore based on the documentation provided to the IESC by an agreed cut-off date and presentations undertaken on the basis of conference calls during the week of February 14, 2022. As such, this IESC review is not as comprehensive as presented in pre-2020 reports as it was not possible to make field observations as is the normal approach to monitoring.

PNG LNG continues to have good performance. Despite COVID-19, 2021 production continued to be above projections and the Project had its best ever safety and security performance. Construction for the Angore project has re-started with the preparation of Wellpad C. The level of effort associated with the recovery from the M = 7.5 February 2018 earthquake might have been underestimated, but recovery continues to progress effectively. Also noteworthy in 2021 has been the participation of PNG nationals in the workforce (91%) with the note that females make up 20% of the PNG workforce. Women make up about 25% of the PNG field workforce, which is the highest worldwide within the ExxonMobil organization.

Environmental and Social Management System

The Environmental and Social Management System (ESMS) is a mature and active System. As such, it continues to evolve and be revised. Over the past year the overall ESMS has remained as before, but where there has been change with respect to the enhancement of the ExxonMobil internal OIMS system. Aspects of the OIMS revisions especially appreciated by the IESC are the increased focus on third-party performance, the strengthening of self-evaluation through leading and lagging indicators, as well as increased prioritization of each OIMS objective in terms of serious community or environmental impacts. EMPNG has not undertaken any Management of Change process requiring Lender notification over the past year.

Pollution Prevention

Environmental management is a subject best reviewed from field observations but based on information provided by EMPNG there are no major problems to report, and past problems continue to be eliminated. EMPNG continues to monitor Environmental Compliance Incidents (ECIs) and EMP Non-conformances (NCs), which indicates that the Environmental Management System is healthy.

Waste and Water Management

Overall, there has been a slight decrease in waste generated from 2020. In the Upstream area there is good landfill capacity and the Synergy Waste Initiative with OSL (with use of the OSL incinerator) has started up again as no incineration is planned at HWMF. The future of the incinerator at the HWMP facility remains to be seen. Waste management at the LNG plant has reached the limit of what can be undertaken internally at the LNG Plant as the landfill is 100% full. EMPNG's solution is two-fold: construct a new landfill at the location of Construction Landfill C; and continue to support Total Waste Management (TWM) in their development of an integrated third-party waste management facility. EMPNG has used the TWM incinerator at Roku since the beginning of Q3 2020 and has continued to work with TWM Roku in 2021 to develop their landfill and industrial wastewater treatment plant facilities.

Wastewater treatment is the best since the start of production. Improvements can be attributed to CEPA approval to use onsite labs for compliance and verification monitoring, as well as assigning personnel dedicated to operation and maintenance.

Three new groundwater monitoring wells were installed in 2021 around the Hides Waste Management Facility (HWMF), where possible evidence of infiltration of leachate from the facility has been recorded since 2014. The data collected from the new wells indicate that anomalous chemical concentrations suggestive of landfill leakage are most likely of natural origin, but these wells still exhibit some anomalies that are not easy to interpret and additional sampling and analysis from all of the wells is necessary to better understand groundwater conditions around the HWMF.

The groundwater monitoring network surrounding the landfill at the LNG Plant has identified some anomalous measurements of barium, selenium, manganese, iron, and a range of other analytes (e.g., zinc, iron, calcium,

magnesium, nitrate, nitrogen) without identifying an obvious plume in the groundwater where westward flow towards Caution Bay would be expected. A third-party review of the test data confirms the complexity of the distribution of anomalous concentrations of analytes outside of relevant permit criteria but does not identify the landfill as a definitive source. The study notes that local groundwater is saline and therefore not a resource but recommends improvements to the monitoring network and sampling procedures to assist in understanding potential sources of the elevated analytes in the groundwater and assessing the adequacy of the coverage provided by the groundwater monitoring network, relative to the risk posed to downgradient groundwater receptors.

Hazardous Materials Management and Spill Prevention

The verification of hazardous materials management practice is something that requires field observation, which could not be undertaken for this review, but this is not an issue that the IESC has ever identified during the Production phase of the PNG LNG project. Spills continue to be consistently recorded and their causes investigated, and procedures developed to minimize future spills. The number of spills in 2021 was reduced from 2020 with an 89% decrease in spill volume. None of these spills had significant environmental consequence.

Air Quality and Noise

An unplanned power outage at OSL Kutubu CPF caused an increase in flaring at LNG Plant such that there was an overall increase in 2021 with 1,472 MMscf vs. 556 MMscf in 2020, but it should be recognized that flaring represents less than two percent of project air emissions with 90% originating from turbine generators. To determine the quality of the main emissions, stack testing was undertaken in 2021. At the LNG Plant all 17 sources were found compliant. At HGCP the two gas turbine gensets tested failed for NOx (the standard is 42 ppm and concentrations of 43 and 48 ppm recorded). NOx emissions are controlled with SoloNox technology, which does not kick in until load capacity is >50% and the gas turbines are currently operated at <35% load capacity. EMPNG is looking at ways to either improve performance or request an MOC. EMPNG continues to review opportunities to further reduce emissions per ExxonMobil's 2030 Emission Reduction Plan (ERP). Noise monitoring was undertaken in 2021 with no problems to report, including at Moro X where baseline noise levels were established in 2020 and also at Angore Wellpad C. Vibration monitoring was also conducted in January 2022 in association with pile driving at Wellpad C with results within generally accepted international standards.

Erosion and Sediment Control

The earthquake caused some serious problems with respect to slope failures in the Upstream area, including at the wellpads and spinline, Komo airfield, and along the pipeline route. Repairs and remediation appear to have been underestimated. In January 2019 costs were estimated to range between \$295 and \$410 million for repairs to these components with completion projected for August 2021. In February 2022 completion is projected for May 2025 and \$344 million has been spent to date out of a total forecast of \$563 million. In spite of the unexpected difficulties, recovery continues to progress effectively. After years of construction the erosion and sediment control system at the Komo airfield is finally complete and looks to be a permanent solution to an endemic problem. Pipeline repairs also relate mainly to issues of erosion and sediment control and 6 of 29 repair sites have been completed. The completion of the Moro Camp expansion in 2021 is now facilitating access to the pipeline right-of-way.

Ecological Management and Biodiversity

EMPNG has restructured the BIMP to differentiate between activities related to monitoring for residual impacts, and those related to offset programs. The IESC endorses this restructured update and will separately provide a small number of recommendations. We do note there is little mention of how stakeholders (other than community and government) are being or will be engaged, such as national/international conservation non-governmental organizations (NGOs), as was recommended in the EIS.

During the reinstatement of construction-phase helipads to enable recent maintenance visits, vegetation clearance occurred outside of the approved clearance zones. The service contractor engaged to reinstate the helipads (1) undertook non-approved clearing around a former helipad at KP284, as the site was not on the intended helipad reinstatement list, and (2) at two locations (KP 290 and again at KP284), trees and other vegetation were cleared outside of the zone approved to be cleared. Clearance of up to a RoW width of 59m occurred. Site verification must now be performed by EMPNG prior to any intrusive works, to ensure clearance boundaries are fully understood.

Analysis of remote sensing imagery for Programmed Monitoring Activity (PMA) No.1 continues to help EMPNG understand whether areas of forest loss or land cover change/degradation might be attributable to the presence of Project infrastructure and retained construction roads. EMPNG states that no broad scale forest loss or habitat degradation was observed, no Project-attributable clearing or degradation, and therefore no change to the No Net Loss (NNL) offset targets. However, the IESC makes an Observation that it appears the Project is not fully considering the potential for indirect impacts, and therefore potentially not correctly classifying whether community land cover change might be enhanced due to ease of access associated with Project footprint, and therefore

attributable. We acknowledge this might not be classed as 'broad-scale' (although this has not been defined) and not always easy to determine, but indirect impacts do need to be considered and acknowledged.

Specialist biodiversity surveys were undertaken in 2021 as part of PMA3, this time with a fully PNG-national team of species surveyors and logistics personnel necessary for successful fieldwork. The scientific team leaders who had led previous years surveys provided remote guidance as travel restrictions hampered their in-person participation. Samples and results are currently being analyzed and the output report will be available later this year. A record number of rodents were observed on Hides Ridge, and the team will be analyzing the ecological implications of this. None of the individuals captured was an introduced / invasive species. A recommendation from the 2019 PMA3 survey to better understand the observed threats from increased hunting pressure and feral dog predation in areas around Project infrastructure has been actioned through the development of a pilot hunting questionnaire to be used for conversations with communities in those areas.

The updated PMA-4 protocol is now in use. The calculated debt required to compensate for that loss through offset currently stands at 17,410 hectares – 2,855 hectares in the lower elevation, 1,070 in the middle elevation, and 5,357 in the upper elevation. EMPNG also retains its 'notional target' of 50,000 hectares to be gained in each elevation zone which was developed in recognition of the assumptions used to determine the offset losses and gains. Projected biodiversity gain trajectories derived from averted loss calculations were presented and compared with habitat hectare gain targets for each of the low/medium/high altitudinal zones. New Conservation Deeds to be formalized from work in the Lower Kikori will start to boost averted loss gains. The Project will shortly identify habitat condition within each of the elevation offset program areas, plus start tracking positive/negative changes in habitat condition to inform loss/gain calculations.

At the Projects only direct intersection with a nationally protected area (and internationally recognized Ramsar site), the Lake Kutubu WMA, work has started on revising the WMA Management Plan. As part of EMPNG's offset program at Lake Kutubu, a contractor is in place to develop the Plan, with a final version to be delivered by the end of 2022. The IESC considers this a tight but not impossible schedule, but will require a considerable amount of international, national, local engagement necessary for the development of a Plan consistent with good international practice. EMPNG advises that IUCN guidelines on protected area management plan development will be adhered to. For the Lake Kutubu WMA Management Plan to be adequate and reflect a sound 'status-pressure- response' approach, a thorough baseline of all priority biodiversity is necessary. EMPNG's PMA-3 terrestrial surveys undertaken in 2017 will be useful, but an up-to-date baseline of the freshwater lake ecosystem is also necessary; especially the status of the endemic fish species and swamp forest for which the Lake Kutubu WMA was originally established. EMPNG has always stated that freshwater biodiversity values do not form part of their offset program; on the other hand, they state that if the WMA Committee chooses to include fish conservation and monitoring activities in their work plan then EMPNG will support it. During IESC conversations with the WMA Committee in 2017, it was clear that health of fish in the lake was of great importance to the Committee. New for 2021 was information presented on a potential new protected area, west of the Lake Kutubu WMA and dialogue with the communities is ongoing.

Engagement with communities for the Lower Kikori offset program has continued, and the Project believes it is proving successful in bringing in more communities (and a younger demographic) that wish to participate in the conservation program. Of the 18 Conservation Deeds that are planned to enable protection of conservation values across the delta, 11 of these have now been completed and the process to formalize the Deeds is commencing. The Project reports that tribes and clans are now driving conservation themselves, encouraging even more communities to engage in the process of natural resource mapping, identifying clan boundaries and demarcating zones specific for fishing, timber-harvesting, conservation and domestic zones.

The IESC is encouraged to finally hear that early offset planning and engagement is occurring at the higher montane zone, where EMPNG intends to establish a protected area at Gigira (Hides Ridge). This is an area already identified as a priority ecosystem in the Biodiversity Strategy (along with the Homa-Benaria/Homa Deviation and Lake Kutubu), plus noted in Wildlife Conservation Society's conservation hotspot work¹ as one of the key areas for protection to preserve biodiversity in the Kikori Basin catchment. A three-pillar engagement program is underway targeting local employees at HGCP, schools in the area, and communities specifically in the PDL1 and PDL7 areas where significant biodiversity values exist. Challenges remain, including ongoing tribal fighting, but the Project is now starting to identify how to implement the BIMP process for establishing newly protected areas as part of the long-awaited Upper Elevation Zone offset program.

¹ Whitmore et al, 2017 - Protected Area Planning for the Kikori River Basin. This report was the primary output from EMPNG's offset component #1, to identify key conservation areas for possible protected area management.

Following a risk assessment to identify potential threats to successful conservation outcomes in protection areas in the offset program, EMPNG is establishing an Alternative Livelihood Strategy and series of plans specifically to target support in those areas being protected. The IESC agrees that successful conservation should be cognizant of the needs of people in and around areas of high ecological and ecosystem value. Such an ALS program, if suitably funded and managed through time, should help achieve sustainable gains over the required timeframe and increase the chances of offset success.

The last IESC report provided background on EMPNG's responsibilities in relation to PS6 (2006) Paragraph 11 relating to operating in a legally protected area, including those related to the promotion and enhancement of the conservation aims of the protected area. The IESC Observation recommends EMPNG now consider the gaps in alignment between the approach taken for offsetting residual impacts on specific biodiversity values versus the requirement to promote and enhance the conservation aims of the protected area within which the Project is located.

Induced Access

There is little change to report for 2021. There has been no change to previous updates regarding any requests from the Government related to handover of Project road-infrastructure such as the Southern Highway (Gobe to Kantobo road section) and the Kaiam Bridge. Of the 15 facilities/infrastructure areas being monitored for unauthorized access, EMPNG report that 12 are controlled and 3 remain uncontrolled as per the EMP requirements: Angore gathering station and spinline (there is a spotter at the Angore gate); CV1 onto the RoW; and MLV1 near Benaria Station. Aerial patrols continue to observe the full RoW and report no observed signs of logging, and no bypassing of access controls. At the LNG Plant, the concrete blocks continue to deter people seeking to harvest wood from the mangrove area at the RoW landfill.

Reinstatement and Regeneration

Regeneration monitoring was undertaken again in 2021 and overall conclusions are that the RoW is progressing along the expected trajectory for restoration of secondary rainforest although succession is progressing at varying rates seemingly dependent on elevation and vegetation type. With regard to structural recovery, BRC notes a convergence is taking place towards secondary forests (as defined by the benchmark data) for the ground and canopy cover, the cover of individual life forms, as well as the density, species diversity and biomass of juveniles and mature trees.

A critical issue noted by the specialist contractor BRC is the higher cover of weeds noted in the RoW than the reference benchmark plots. They note a number of regenerating areas harbor high densities of juvenile *Piper aduncum* (Priority 1 weed, Spiked Pepper) which potentially threatens to invade the tree canopy once they mature. As forest regeneration is entering an important phase of canopy closure, this typically means vegetation composition becomes fixed at the time of closure. Regarding comparison of monitored plots with benchmark plots, BRC notes that composition of regenerating vegetation on the RoW is not indicating any convergence with the benchmark plots, although this might just mean a different but equally direct pathway back to forest regeneration. The next survey will be in Q1-2024.

Invasive Species and Quarantine Management

Lenders will recall previous IESC reviews trying to gain an understanding of the distribution, abundance and spread of weeds, locations where weed control is particularly challenging, updates on priority areas for P1 high priority weeds control, etc. This information is still not being presented to allow Lenders/IESC to understand whether concerns are being addressed. EMPNG states that weed control is ongoing at known sites, and that new sites are added in a timely fashion. They state resources are managed, training is given, adaptive management is occurring, along with strategic planning and site verification. EMPNG has provided an updated weed Register again with no analysis of weed management challenges.

The IESC considers this subject increasingly difficult to review via remote desktop review. From the Register provided it is difficult to search for control of weeds at key priority areas and identify areas that are proving challenging for weed management. It is difficult to determine if some areas are more commonly infested that require more targeted repeat control. Site specific weed observations may be made by BRC during their monitoring surveys and emailed into HQ, and the Register lists every control event location and weed species targeted, but the system lacks the ability to be interrogated and for any analysis. As reported a number of times in previous IESC reports, access to key priority areas by the weed inspection and control contractors has been hampered by logistical (e.g. availability of cars) and security challenges, the 2018 earthquake and COVID-19 travel restrictions.

High level results from the 2021 survey across the Upstream area were presented. A total of 389 transects, 500 m² each, were undertaken across all four elevation zones. EMPNG's objectives are to prevent priority weeds from becoming established in the vicinity of their facilities and infrastructure; however, as is noted in the regeneration monitoring section above, unfortunately as noted in the Regeneration section, the P1 weed *Piper aduncum* has

become firmly established within the regenerating RoW, especially in the mid-elevation zone (400-900 meters above sea level). The BRC report notes that frequent repeated disturbance exacerbates the spread and dominance of *P. aduncum*, and that avoiding repeated cutting/disturbance should be part of the control strategy – this has consequences for RoW maintenance and pipeline integrity strategies where regular vegetation cutting is required.

The priority ecosystem of the Homa Benaria Ridge was finally surveyed by BRC in Nov 2021 following a two year absence of the monitoring team due to on-going security concerns and the quarantine arrangements introduced in response to Covid-19. Although the overall number of all weed species was lower in the Homa-Benaria transects than the average of all other Low Montane transects, the fact that it had a higher proportion of P1 weed species than other Low Montane areas does give concern. Conclusions from the report presented to the IESC do not seem to acknowledge the priority ecosystem nature of the Homa Benaria area. During Pre-Construction, the area was noted as a mostly undisturbed habitat, having similar qualities to Hides Ridge, being largely weed free, primarily as a result of having no vehicular access.

EMPNG proposes to move from annual weed monitoring to monitoring surveys every two years. Considering that IESC has repeatedly flagged weed management as an issue yet to be adequately managed/reported, and that BRC themselves recommend annual surveys continue, we strongly recommend that an annual specialist assessment continues.

As reported in the last few IESC reports, cane toads (*Rhinella marina*) have become an increasingly challenging invasive species in the Upstream Highlands area. This toxic pest affects native fauna that die due to ingestion of their poison and can create imbalance across ecosystems wherever they are found. The Project's cane toad program strategy continues to be to limit the introduction of cane toads into priority ecosystems (Hides Ridge, Homa-Benaria Ridge and Lake Kutubu WMA). Target areas for prevention, detection and response are the HGCP, the Hides vehicle-washdown facility, the Hides Waste Management Facility (HWMF) at Kopeanda, Moro, Komo and Angore. Although cane toads are still prevalent at HGCP and HWMF, data reported for 2021 indicate their numbers are much reduced due to control measures introduced by the Project.

Previous PMA3 biodiversity surveys had observed increasing stress in *Nothofagus* trees along the forest edge on Hides Ridge over the last few years. Although not yet proven, this could potentially be due to the plant pathogen, *Phytophthora cinnamomi*, to which *Nothofagus* trees are particularly susceptible; other contributing factors could include changes to drainage, light conditions and soil disturbance. The last IESC report recommended EMPNG consult appropriate pathogen experts to determine whether specialist sampling is warranted at dieback sites on Hides Ridge for exotic Type A2. During this desktop review, the Project advised sampling had not yet occurred, but photographs of the suspected dieback had now been sent to the PMA3 scientific team leaders for their assessment. The IESC recommends more urgency in EMPNG's approach so that priority analysis is undertaken of any suspected dieback on the Ridge, and the type of dieback determined (A1 or A2), to confirm whether active control measures should be implemented – a new Observation is noted.

Finally, a wallaby (*Macropus agilis*) over-population issue at the LNG Plant has required dialogue with species experts at the Port Moresby Nature Park and CEPA to identify the most appropriate solution to manage and reduce numbers on the site. EMPNG states that during 2021 a significant increase in the population has been observed, posing a safety/health/security concern as attempts have been made by local hunters to hunt the animals through the fence and retrieve carcasses. CEPA approved the request for a partial cull of up to 1000 animals by a professional shooter and noted a number of specific conditions to be followed during the cull, scheduled for Feb 2022.

Resettlement

Resettlement obligations remaining from 2020 have been closed with no outstanding obligations for the Project. Resettlement activities initiated in 2021 required for Angore Wellpad C, pipeline remediation, demarcating permanent exclusion zones or widening of the pipeline ROW are being planned and implemented consistent with PS5 requirements and reviewed by the IESC. Of the nine affected areas along the pipeline five are completed with no outstanding obligations, one area requires outcome evaluation, and three areas require conclusion of agreements. Outstanding actions are expected to be completed in March.

Losses incurred by the affected households include gardens, some of which are fallow, and most households have gardens elsewhere. The four households that lose a dwelling for which they will be compensated have access to dwellings elsewhere. A few bush or auxiliary structures will also be affected and compensated for.

Community Impacts Management

The Project provided more detailed information on conflict between clans and security in communities, as requested in the IESC 2020 report.

Tribal conflicts in the Upstream areas continue to be relatively calm, particularly in Hela and Southern Highlands provinces where EMPNG has its operations. Some localized conflicts in early 2021 contributed to generalized political and economic instability in Highlands provinces that occasionally caused disruptions along critical supply routes for EMPNG. Two major tribal conflicts (Teri and Angore) led to elevation of the Project Security Level and non-critical activities suspended until the situation stabilized. As a result of PNG government and foreign aid intervention, tribal fights subsided for the rest of 2021. EMPNG continues to cooperate and support the United Nations PNG Highlands Joint Programme focused on conflict resolution and peace building in Hela and Southern Highlands provinces.

Disputes over landowner royalty and equity payments and grievances with government policies, as well as high employment expectations, led to sporadic threats, public disturbances and minor acts of vandalism directed towards PNG LNG causing minor damage to project assets. The incidence of crime also is high in the Highlands region, exacerbated by adverse economic impact of COVID-19. In response, The GoPNG announced a new program of support to the law-and-order sector for Hela Province. EMPNG continues to partner with the Australian government-stewarded Justice Services and Stability for Development program to improve the law and justice sector in Hela.

Community Development Support

Community Development Support (CDS) has started work on a 5 Year Framework/Action Plan for 2022-2016. The initial phase is focused on Program design considering key program area objectives (including selection criteria for evaluating potential projects against program goals and objectives) for Upstream North, Pipeline ROW and LNGP Plant site areas. Main issues to be considered include area context, focus areas, risks, and Government alignment. Other elements of the 5-year planning are development, implementation and management arrangements (Execution model) and a Monitoring and Evaluation (M&E) LogFrame/Results Framework.

The IESC 2020 report noted that significant progress had been made toward achieving Cross Functionality - a Project-wide comprehensive and coordinated community support program that guides the contributions of all Project components (CDS and other components) to promote consistency in selection criteria, implementation, results assessment and reporting. In 2021, these groups have been active resulting in growing consistency in selection of community-oriented programs.

A preliminary assessment of data on program components from 2015-2020 shows:

Upstream

- ✓ Spend on the Community Livelihood Improvement Project (CLIP) has been US\$1m/year. In terms of thematic category spend, 57% was spent on livelihood initiatives, 21% on education initiatives, 20% on health and 3% on Law and Justice;
- ✓ Positive outcomes for agriculture and health programs;
- ✓ Growing stability in hot spot areas;
- ✓ Hides and Komo key leaders increasingly involved in the CDS program;
- ✓ Rugby League sports a medium for youth involvement in promoting community stabilization.

Plant Site

- ✓ Execution and spend low against annual allocation 2015/2016;
- ✓ Collaboration with Gas Resources Directors in 2018 and 2019 on project identification maximized EMPNG and Mineral Resources Development Company to do more community Infrastructure;
- ✓ School Governance training at Plant Site villages positively influenced introducing School Board training as targeted area in National Education Plan;
- ✓ Positive outcomes from both education and livelihood programs.

In terms of recommendations, the IESC notes the following:

- ✓ The Project consider developing implementation and management arrangements and the (M&E) procedure during the Design stage and that Cross Functionality be included in CDS implementation arrangements;
- ✓ Provide IESC with information on the role of the Consultant in the CDS design;
- ✓ Thematic focus areas (livelihood, health, education, law and justice) be re-evaluated in the new Strategy considering that primary themes should be those in which the Project concentrates its attention;
- ✓ The 5 Year Plan/Strategy include provision of the specific role(s) of the Project in descriptions of CDS activities, such as financial, involvement in planning and/or implementation, etc.

National Content

PNG Nationals now compose 89% of the Project's workforce – a slight decrease of 2% from 2020 attributed to the inclusion of smaller highly skilled 3rd Party Contractors (in reporting) and resumption of Angore & EQR ROW. . The number of contractors included in reporting National Content increased from 16 to 25. The actual number of PNG staff is 2,978 at the end of 2021 compared to 2,539 at the end of 2020 indicating recovery from the decrease at the end of 2020 due to COVID 19 impact. &M Intake 6 technicians on boarded.

Of the 89% of PNG workers, 45% are from Project Impact Areas. In terms of gender, females make up 18% of PNG workforce. EMPNG O&M workforce is 34% female, among the highest in ExxonMobil worldwide, 65% of field site work force are female and females hold 11% (67 staff) of the management roles. In terms of Competency Enhancement, 117,000 training hours were delivered in 2021- up from 86,000 hours in 2020.

Operations and Maintenance (O&M) training Intake 7 sponsored 24 Operations Trainees (16 Operations, 8 Instrumentations) at KPA. The Junior Technician training program begun in August will be completed in July 2022 with successful trainees EMPNG. In 2022, O&M Intake 7 trainees will be on-boarded and Intake 8 recruitment will begin in Q2 for a planned 18 trainees.

A number of milestones were reached in 2021, the most important of which are the achievement of 100% PNG Citizen Operations Technicians Upstream in Control Rooms, Plants, Wellpads, Pipeline, and Maintenance technicians in Planning; Upstream Operations and LNGP Operations lead roles are 100% occupied by PNG citizens of which two of the eight are female.

In terms of local procurement during Production, EMPNG has spent over PGK 5b in-country with almost PGK 3.2b with Papua New Guinean businesses of which PGK1.6b spent with Lancos. In 2021, more than PGK490 million spent by EMPNG in-country, of which over PGK184 million with Lancos. Project to date, EMPNG has invested over PGK27 million in PNG business development through the IBBM Enterprise Centre (EC)

Stakeholder Engagement and Consultation

The number of information engagements with large numbers of participants has declined over the last two years due partly to COVID and a shift of focus to smaller groups that address specific issues of importance to particular areas and groups. The IESC concludes that the shift in emphasis is appropriate is appropriate given the stage of the project.

Community Grievance Management

Issues

The number of issues recorded in 2021 is 1,199 – up from 513 issues in 2020. This increase is attributed to significantly increased work fronts as Covid19 impacts decline. Economic issues were the most frequent, related particularly to economic development, employment and Strategic Community Investment requests. Land Access and compensation represents the second most frequent category due to resettlement activities, Clan Agent Change and annual deprivation payments. A few issues related to community health and safety concerns

Grievances

A total 20 grievances were filed in 2021 most of which related to the environment due to new construction. Of the 20 grievances, 14 were closed in 2021, 1 was closed in early 2022 and five of the more complicated grievances are under still being investigated to reach conclusion on mutually acceptable resolutions.

Landowner Beneficiary Payments

The Project's strategy remains to mitigate near-term risk, support resolution of underlying issues, and capture lessons for potential future projects. To these ends, the Project continues positive engagements with CoVs, PNG Government and other stakeholders. EMPNG provides logistical support to government activities as appropriate.

Progress is being made to deliver benefits to mandated beneficiaries. Upstream payments are in progress with status varying between Petroleum Development License (PDL) areas. The Project understands that a total of K63M in royalties and equity have been paid since 2017 and that future beneficiary payments for some of the PDLs will be released later in 2022.

Labor and Working Conditions

Labor Grievances and Inquiries

Only two grievances, both for harassment, were investigated during 2021. No time was lost to industrial action. As in 2020, the utilization of 'HR Direct' that allows employees to direct questions to appropriate teams through an

automated system greatly minimized the number of issues that could escalate to grievances. From January to November 2021, 609 inquiries were received with an average response time of one day. Most inquiries were in regard to Savings Plan, HOAP and medical plans.

Professional Development

Right Work, Right Way, Performance Assessment and PNG Talent Strategy were rolled out in 2021. The Project continues to use various kinds of materials and activities to support workforce professional development. Key activities include the Supervisors Network's virtual sessions for supervisors, Employee Development virtual sessions focused on guidance for employees to get the best out of their careers and as individuals and a Mentoring Program that aims to enable employees to acquire the knowledge and skills that help them reach their ultimate potential and maximize their contributions to Company goals. The Project also employs a number of other mechanisms to foster professional development, such as the Toastmasters Program, Professional Development Awards, and the Workforce Giving Back (to communities) program.

Personal Development

The Project supports staff personal development with various measures such as Business Acumen - Employee Finance Basics, International Women's Day activities, Women in Energy (WEN) Networking sessions and access to professional counseling.

Community and Occupational Health

Community health continues to be a component of the CDS program. In the Upstream area EMPNG continues to support the Hela Provincial Health Authority with food and other operational support, but especially with funding support to help manage COVID-19, as well as providing capacity training for health workers through Texas Children Hospital. 2021 support also resulted in EMPNG being invited to join as a member of the Hela Partnership Forum. In the area of the LNG Plant EMPNG has also continued focus on COVID-19 responses with the leaders from the four local villages and Central Provincial Health Authority (CPHA). Another highlight in 2021 is that EMPNG started the construction and installation of the CPHA Pharmacy and Dispensary Unit at Konedobu. This will help improve timely disbursement of drugs to all district and community health facility at LNG Plant communities.

The occupational health program is world class and continues to perform well in all areas (clinical operations, public health and industrial hygiene). The dominant issue in 2021 was again the COVID-19 pandemic, which continues to be well-managed. Vaccination coverage at the LNG Plant is 96% and 100% in the Upstream areas.

The Culture of Health (COH) program continues to be implemented with a COH Week undertaken in October 2021 focusing on biometric screenings, physical activity challenges, and mental health webinars. The Industrial Hygiene Program continues to review worker exposure to chemicals and noise and verifies that personnel protective equipment is appropriate for the different work environments. A significant change to a long-standing program is with respect to requirements for protection against malaria as non-immune workers in Port Moresby and the LNG Plant are no longer required to take chemoprophylaxis while the random testing has been discontinued for all sites (Port Moresby, LNGP and Upstream). Requirements in the Upstream area are being reviewed.

Occupational Safety

EMPNG Production safety performance through Q4 2021 continues to be excellent. The last Lost-Time Injury (LTI) was an attack on a worker from another worker in 2017 (not an accident) with more than 55 million work-hours worked since that incident and prior to that incident the Project had been LTI free for more than a year. This is a remarkable testament to a robust safety program.

Cultural Heritage

Cultural heritage management continues to be undertaken, currently in association with the Angore project, and preferred practice continues to be avoidance. In 2021 efforts in the field for the management of chance finds continue has continued with additional training of field personnel. Lithic artifacts identified from chance finds at Angore Wellpad C have been turned over to the PNG National Museum & Art Gallery. A focus of cultural heritage activities in 2021 has been to provide awareness on cultural heritage significance of the project footprint areas with project personnel and local stakeholders. Social Research Institute has been selected to document cultural heritage related legends and significant chance finds from the project footprint areas to teaching material targeting school children. A book is being prepared to document "Ethnographic and Archaeological Studies" on cultural values significant to the people and places along the ExxonMobil PNG LNG project footprint in Papua New Guinea.

1 INTRODUCTION

RINA Consulting (hereafter 'Rina'), formerly D'Appolonia S.p.A., located in Genoa, Italy, was appointed as the post-financial close Independent Environmental and Social Consultant (IESC) for the Papua New Guinea Liquefied Natural Gas Project (PNG LNG or the "Project") being developed by ExxonMobil PNG (EMPNG), the designated Operator and also representing a consortium of co-ventures including: Oil Search Limited; Kumul Petroleum Holdings Limited; Santos Limited; JX Nippon Oil and Gas Exploration Corporation; and Mineral Resources Development Company Limited, and their affiliates. Rina's role as the IESC is to support the Export Credit Agencies (ECAs) providing Project financing, including the Export-Import Bank of the United States (USEXIM); Japan Bank for International Cooperation (JBIC); Export Finance and Insurance Corporation (EFIC) of Australia; Servizi Assicurativi del Commercio Estero (SACE) from Italy; Export-Import Bank of China (CEXIM); and Nippon Export and Investment Insurance (NEXI), as well as a group of commercial banks, collectively referred to as the 'Lenders' or 'Lender Group'.

The overall role of Rina as the IESC within the PNG LNG Project is to evaluate conformance with commitments made by EMPNG within their Environmental and Social Management System (ESMS) including health and safety. The benchmark for the ESMS is now the Production Environmental and Social Management Plan (ESMP), supplemented by the associated environmental and social support plans, also including associated commitments made within the ExxonMobil Operations Integrity Management System (OIMS) and the documents associated with biodiversity management.

The IESC Terms of Reference (TOR) requirements refer to an evaluation of Project "compliance", whereas the reporting requirements of the TOR state that the reporting will include a "list of non-conformance findings". Within this report, the terms "compliance" and "conformance" are considered to be equivalent. In general, issues to be resolved are identified as non-conformances, but one of the requirements of the IESC is to identify any "material non-conformances" within the context of the Common Terms of Agreement (CTA). The IESC believes that a "material non-conformance" within the context of the CTA would need to be a Lender decision, but for the purposes of this report a potential "material non-conformance" would be a Level III non-conformance or repeated Level II non-conformances as defined in the Section 2 Issues Table. It is emphasized that a Level III non-conformance is not necessarily equivalent to a "material non-conformance" and that extensive discussions among EMPNG, Lenders and the IESC would need to take place before any "material non-conformance" is identified.

The IESC's review has included the environmental and social (E&S) and health and safety (H&S) management activities of EMPNG. This report has been conducted from a desktop review based on information provided by EMPNG without undertaking a field visit as access restrictions related to the outbreak of the Coronavirus (COVID-19) prevented the IESC from visiting the Project for the third year in a row. The review was therefore based on the documentation provided to the IESC by an agreed cut-off date and presentations undertaken on the basis of conference calls during the week of February 14th. As such, this IESC review is not as comprehensive as presented reports prior to 2020 as it was not possible to make field observations as is the normal approach to monitoring.

An activity that does not fall under the category of "monitoring" yet is within the scope of the CTA is a requirement for the IESC to certify certain non-Project operations (section 14.2(m)(iii) of CTA). Since the last review in February 2021, there have been no requirements for the IESC to prepare any supplemental certifications.

1.1 PRODUCTION OPERATIONS OVERVIEW

2021 was a good year for production, in spite of COVID-19, with 8.4 million tons (MTA Eq) and 110 LNG cargoes loaded (including the 800th since start-up). It should be recalled that the project was defined to the IESC in 2009 to be a development of 6.3 MTA Eq, so current production continues to be significantly more than originally projected. Figure 1.1 depicts 2021 LNG production.

Angore field activities were suspended in November 2018 after execution progress was affected by the earthquake in February, site incursion and vandalism in June 2018, and a near-miss security incident in October 2018. Angore construction is now ongoing. Wellpad C construction was re-started in July 2021 and the work is on schedule for a 2024 start-up. Bulk earthworks are effectively complete and pile driving started at the end of January 2022. Construction of the ~13 km 14" gas and 2" MEG lines with associated high voltage (HV) and fiber optic cables connecting Angore with the HGCP is scheduled for a construction re-start in Q3 2022. Figure 1.2 shows a recent photograph of Wellpad C.

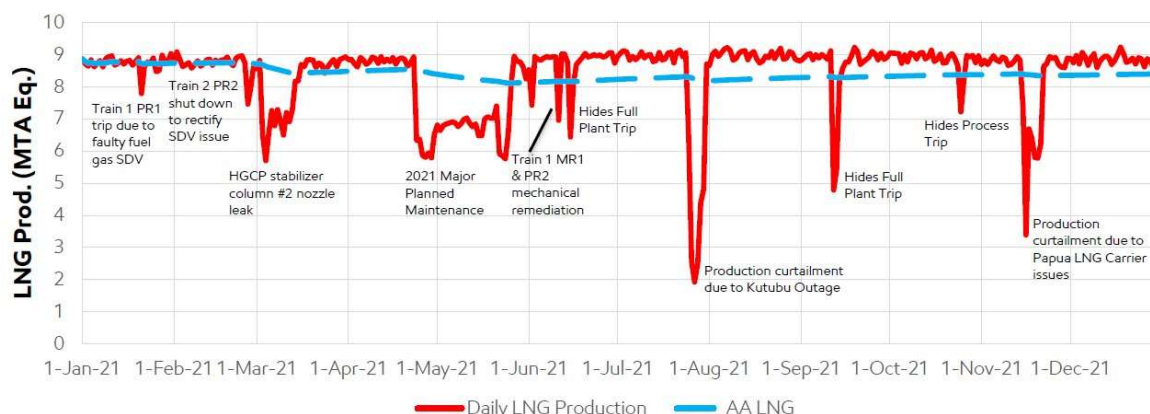


Figure 1.1: 2021 LNG Production



Figure 1.2: Angore Wellpad C in January 2022

The effort associated with the recovery from the M = 7.5 February 2018 earthquake has been impacted by COVID-19 restrictions. The initial response to the Earthquake was humanitarian where ExxonMobil provided support to EQ recovery through donated services including Logistics, and consequently the recovery efforts to the facilities were assessed in two phases. The recovery was impacted by COVID-19, with the majority of Phase 1 works being completed and recovery now continues to progress effectively of all remaining scopes of work. At the end of December 2020, USD\$285 million had been spent against an estimated total forecast of USD\$500 million a result of the earthquake. At the end of December 2021, USD\$344 million had been spent against an estimated total forecast of USD\$563 million. In February 2020 completion was projected for April 2024; in February 2022 completion is projected for May 2025. In spite of the two-phase approach to scope identification and delays due to COVID there is good progress to report. Hides major repairs are complete with minor structural repairs nearing completion and the firewater tank repair engineering phase is underway for 2022 completion. Construction of a permanent drainage system at the Komo airfield was completed in September 2021. Runway preservation is complete, and a full repair of the runway is being evaluated. Repairs along the Pipeline Right-of-Way (RoW) continue with repairs complete at 6 of 29 repair sites (see micropiling at KP 64.5 in Figure 1.3). Work along the RoW has accelerated after completion of the Moro Camp expansion and staging area in 2021.



Figure 1.3: ROW Stabilization – Installing Micropiles at KP 64.5

PNG Nationals now compose 89% of the Project's workforce of close to 3,300. The actual number of the PNG staff is up to 2,978 Nationals compared to 2,539 at the end of 2020, related mainly to the startup of Angore construction. In terms of gender, females account for 18% of the PNG workforce. EMPNG O&M workforce is 34% female, among the highest in ExxonMobil worldwide.

1.2 SOURCES OF INFORMATION

The main sources of information used to prepare the report are from documents and presentations provided by EMPNG and discussions held with EMPNG personnel via conference calls. As noted above, the IESC was not able to conduct the site visit due to travel restrictions related to the outbreak of the coronavirus.

1.3 REPORT ORGANIZATION

Subsequent sections of this report are organized as follows:

- ✓ Section 2.0 – Issues Table;
- ✓ Section 3.0 – Environmental and Social Management;
- ✓ Section 4.0 – Pollution Prevention;
- ✓ Section 5.0 – Biodiversity and Ecological Management;
- ✓ Section 6.0 – Social;
- ✓ Section 7.0 – Labor and Human Resources;
- ✓ Section 8.0 – Health and Safety; and
- ✓ Section 9.0 – Cultural Heritage.

The basic findings of the review are presented in the form of observations, comments and recommendations that are generally described according to topics within each section. Significant findings are summarized in the Issues Table provided in Section 2.0.

2 ISSUES TABLE

This Chapter tabulates a summary of the non-conformances raised in this report, consistent with our TOR as discussed in Section 1.0. The Table has been structured to provide a color-coding for strict non-conformances raised during each site visit, as well as IESC observations for situations that if left unattended could result in a non-conformance. Non-conformance is referenced with respect to Project commitments as included in applicable Project documents and with respect to on-going compliance with Applicable Lender Environmental and Social (E&S) Standards. As noted in Section 1.0 of this report, “Applicable Lender Environmental and Social Standards” means the environmental and social standards applied by the Loan Facility Lenders to the Project in the form attached to Schedule H-1 (Environmental and Social – Applicable Lender Environmental and Social Standards) of the CTA. The nomenclature of the color-coded categorizations is assigned based on non-conformance levels similar to the non-conformance levels defined in the ESMP, somewhat revised to reflect the point of view of the IESC and to address that certain non-conformances need to be framed in the context of the Applicable Lender E&S Standards. The following descriptions are provided:

- ✓ **High:** Level III critical non-conformance, typically including observed damage to or a reasonable expectation of impending damage or irreversible impact to an identified resource or community and/or a major breach to a commitment as defined in Project documents or the Applicable Lender Environmental and Social Standards. A Level III non-conformance can also be based on repeated Level II non-conformances or intentional disregard of specific prohibitions or Project standards. In some cases, Level III non-conformances or repeated Level III non-conformances may, but not necessarily, represent a material non-compliance with the CTA. This would be decided on a case-by-case basis;
- ✓ **Medium:** Level II non-conformance representing a situation that has not yet resulted in clearly identified damage or irreversible impact to a sensitive or important resource or community but requires expeditious corrective action and site-specific attention to prevent such effects. A Level II non-conformance can also represent a significant breach of a commitment, or a risk of a significant breach if not expeditiously addressed, requiring corrective action as defined in Project documents or Applicable Lender Environmental and Social Standards. A Level II non-conformance can also be based on repeated Level I non-conformances;
- ✓ **Low:** Level I non-conformance not consistent with stated commitments as defined in Project documents, but not believed to represent an immediate threat or impact to an identified important resource or community. A Level I non-conformance can also represent a minor breach of a commitment requiring corrective action as defined in Applicable Lender Environmental and Social Standards; and
- ✓ **IESC Observation:** A potential non-conformance situation that could eventually become inconsistent with stated commitments as defined in Project documents or the Applicable Lender Environmental and Social Standards.

Item ID	Site Visit	Closing Date	Description	Non-Conformance	Reference	Status	Comments/Report Reference
Environmental Issues – Environmental Management							
M19.1	Desktop review Feb '20 Modified Feb '22		Groundwater monitoring at the HWMF at Kopeanda indicates that waste management operations could possibly be impacting groundwater. There is also uncertainty as to whether the LNG Plant landfill cells could be impacting groundwater (added 2/2022)	IESC Observation	Upstream and LNG Plan EMPs Section 9	Open	Interpretations of the possibility that the landfills at the HWMF and the LNG Plant could be impacting groundwater have been reviewed by TetraTech/Coffey in 2021 with the general observation that in both cases the anomalous concentrations of analytes are probably natural. IESC considers that more sampling rounds are needed before this observation can be considered definitive.
Environmental Issues - Biodiversity and Ecological Management							
M19.2	Desktop review Feb 2020	Feb 2022	PS6 2006 requires mitigation measures to be designed to achieve no net loss (NNL) where feasible, including offset of losses through the creation of ecologically comparable area(s) managed for biodiversity. The Project's stated biodiversity strategy requires the establishment of offsets at each of three elevation zones for the purposes of reflecting representativeness and demonstrating NNL. EMPNG's offset program in the lower and middle elevations has progressed since residual impacts occurred in each zone. Although the Project's approach to offsets in each zone has been quite different, and implementation is still ongoing, the IESC has observed the Project make degrees of progress towards enhancing or establishing protected areas in these two zones. Stakeholder engagement has been focused, external specialist input sought on program development, capacity building undertaken, internal/contractor resources allocated, all contributing to degrees of progress in creating effective protected areas. There is little equivalent demonstrable progress for the upper elevation pursuit of NNL. The IESC acknowledge and note the Project's observation that although security issues have prevented EMPNG's progress so far, the situation appears to be improving.	Low: Level 1	EMPNG Biodiversity Strategy Section 3 EMPNG Biodiversity Implementation and Monitoring Program Section 4 IFC PS6 requirements in relation to Natural and Critical Habitat	Closed	From what EMPNG has provided, it appears that early progress in EMPNG's montane offset program is now being made. The Project has deployed a biodiversity staff member to HGCP with the primary goal to progress early, regular engagement necessary for a successful offset program. An engagement program is underway targeting the three pillars of local employees at HGCP, schools in the area, and communities specifically in the PDL1 and PDL7 areas where significant biodiversity values exist. Challenges remain, including ongoing tribal fighting, but the Project is now starting to identify how to implement the process for establishing newly protected areas as part of the long-awaited Upper Elevation Zone offset program, as described in the BIMP. Progress through the necessary work activities will be followed closely in future IESC visits. (Report reference for background detail: Section 5.2.2.2)
M20.1	Desktop review Feb 2021		As the Project is located within a legally protected area, it has additional responsibilities to ensure tangible benefits to protection of the area, for example carrying out research needed for it to meet its conservation aims. The Project has undertaken over a decade of solid foundational work with the Lake Kutubu WMA Committee as part of the mid-elevation offset program. However, there is a need to consider the gaps in alignment between the approach taken for offsetting residual impacts on specific biodiversity values versus the requirement to promote and enhance the conservation aims of the protected area within which the Project is located. The Project's intentional exclusion of an updated scientifically robust aquatic biodiversity survey in the Lake Kutubu WMA in 2017, to support the preservation of the freshwater ecosystem, is not in	IESC Observation	IFC PS6 Para.11	Open	An updated freshwater biodiversity assessment aligned with the other components of the 2017 PMA3 biodiversity surveys would have provided a comprehensive snapshot of species diversity and abundance, as a basis for the revised WMA Management Plan conservation objectives. The IESC recommends the Project plan to include an updated appropriate assessment of the Lake Kutubu freshwater ecosystem via a PMA3-type biodiversity assessment survey as part of the foundation for enhancing the conservation aims of the WMA. This will provide up to date, PMA-3 comparable data on biodiversity values for input to the development of a Lake Kutubu WMA Management Plan for the protected area.

Item ID	Site Visit	Closing Date	Description	Non-Conformance	Reference	Status	Comments/Report Reference
			alignment with primary conservation aims of the protected area.				
M20.2	Desktop review Feb 2021		As reported a number of times in previous IESC reports, access to key priority areas by the weed inspection and control contractors has been restricted. Security issues, the 2018 earthquake, and a lack of transportation for weed contractors to get to sites, have restricted the likelihood for effective, widespread weed inspection and control. Now in 2020 further security issues and the COVID-19 pandemic meant that weed inspection/control was further hampered. Obviously, some of the challenges noted are outside of the control of the Project. However, the <i>consequences</i> of those challenges are that large parts of the Project's Upstream footprint, including priority ecosystem areas such as the Homa Benaria Ridge, have had little inspection/control for several years. The current situation is not consistent with stated commitments in the EMP, and it is unclear whether the situation represents an immediate threat or impact to priority ecosystem areas. The IESC does not receive any useful analyses of weed inspection/control findings or Project-induced weed distribution/abundance status.	Low: Level 1	Upstream EMP	Open	EMPNG should undertake an analysis of the weed inspection/control data and present to Lenders: ✓ Locations (distribution) of P1 weeds of key concern, currently compared to distribution during the PCS; ✓ Areas where P1 weeds are now so well established and persistent that repeated control is required or is proving difficult; ✓ Ecological consequences of P1 weeds remaining established in these areas e.g. any detrimental impacts on the ability of native species to thrive in their natural habitat; ✓ What adaptive management is necessary in the Project's approach.? EMPNG needs to work with the weed inspection/control contractor to better resource the team, ensuring sufficient headcount and dedicated vehicles to access weed inspection/control sites as regularly as necessary to meet the requirements of the Upstream EMP.
M21.1	Desktop review Feb 2022		PMA-1 uses remote sensing to monitor forest loss, land use change and degradation in the Upstream Area as caused by impacts that are directly Project-related, indirectly Project-related (third party, induced), non-Project (third party, expansion of pre-existing activity), and/or natural change (e.g., landslide). The Project has not been classifying instances of forest loss and land use change/degradation as Project-attributable even though they could potentially be the result of indirect impacts. Only change related to direct Project impacts e.g. installation of new infrastructure, are being considered as Project-attributable. Local landowners have the right to clear their land but when this is in direct proximity to the pipeline RoW or infrastructure, and therefore access to those areas newly cleared may have been enhanced by the presence of the Project (as noted in the 2019 PMA3 survey report), this should be acknowledged and categorized accordingly.	Observation	Biodiversity Strategy	Open	That EMPNG continues to report no indirect Project-related land cover change following ground-truthing needs further consideration. As flagged in previous reports, the IESC now strongly recommends EMPNG reconsider how they distinguish whether observed forest loss and land use change/degradation is potentially attributable to the Project when this is done by landowners or others (related to Section 8.2.7 of PMA1 Protocol, queried previously). The database cataloguing all previous observations requiring follow-up inspection should be checked with this in mind. This might not necessarily have implications for the offset target at this moment in time but identifying what residual indirect impacts might occur (or have occurred) is necessary. (Report reference for background detail: PMA1 in Section 5.2.2.1)

Item ID	Site Visit	Closing Date	Description	Non-Conformance	Reference	Status	Comments/Report Reference
M21.2	Desktop review Feb 2022		During 2019 PMA-3 surveys, potential dieback was noted during transect work up on Hides Ridge. Dieback is caused by the plant pathogen, <i>Phytophthora cinnamomi</i>, and <i>Nothofagus</i> trees as occur on Hides Ridge are particularly susceptible. EMPNG state that photographs were taken of the potential dieback during the 2021 surveys, and these have been forwarded to the scientific team leaders for their visual assessment. However, no sampling has been undertaken to confirm the presence of <i>Phytophthora</i> observed in 2019, or to determine whether it is Type A1 or A2.	Observation	EMPNG's Dieback Infection Management Guidelines	Open	The IESC recommend more urgency in EMPNG's approach so that priority analysis is undertaken of the suspected dieback, and the type of dieback determined (A1 or A2). This should confirm whether active control measures should be implemented in alignment with EMPNG's Plant Hygiene Management Plan. Stringent measures should be in place to prevent the movement of Type A2 (an introduced species) into the priority ecosystem at Hides Ridge. (Report reference for background detail: PMA-3 in Section 5.2.2.1, and Dieback in Section 5.5.2.4)

3 ENVIRONMENTAL AND SOCIAL MANAGEMENT

3.1 ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM

The Environmental and Social Management System (ESMS) is a mature and active System. As such, it continues to evolve and be revised. Key framework documents to the ESMS are the Project Environmental Management Plans (EMPs), which have been upgraded to an advanced draft with the following objectives:

- ✓ ensure EMPs reflect as-built conditions and reflect current practices;
- ✓ provide clarifications to queries that have been raised since Production commenced;
- ✓ include Regulatory changes that have occurred since Production commenced; and
- ✓ incorporate mitigation measures that were included during construction that are still applicable to Production Projects.

The E&S requirements for the ongoing work to develop the Angore Field are defined in a specific EMP for the Angore Gathering System.

Over the past year the overall ESMS has remained as before, but where there has been change has been respect the enhancement of the ExxonMobil internal OIMS system. Aspects of the OIMS revisions especially appreciated by the IESC are the increased focus on third-party performance, the strengthening of self-evaluation through leading and lagging indicators, as well as increased prioritization of each OIMS objective in terms of serious community or environmental impacts.

3.2 MANAGEMENT OF CHANGE

Since the last review in February 2021, EMPNG has not undertaken any Management of Change (MOCs) that would require IESC review. A pending MOC, now reported for several years, is the anticipated turnover of Project infrastructure to the PNG Government. No activity has taken place. The PNG Government has not occupied any of the infrastructure and the status quo is being maintained.

3.3 INCIDENTS

In terms of environmental incidents, the number of spills in 2021 was less than 2020, with a 30% decrease in number of spills and an 89% decrease in total spill volume (Figure 3.1). There were no Corporate reportable spills (>1 bbl) in 2021.

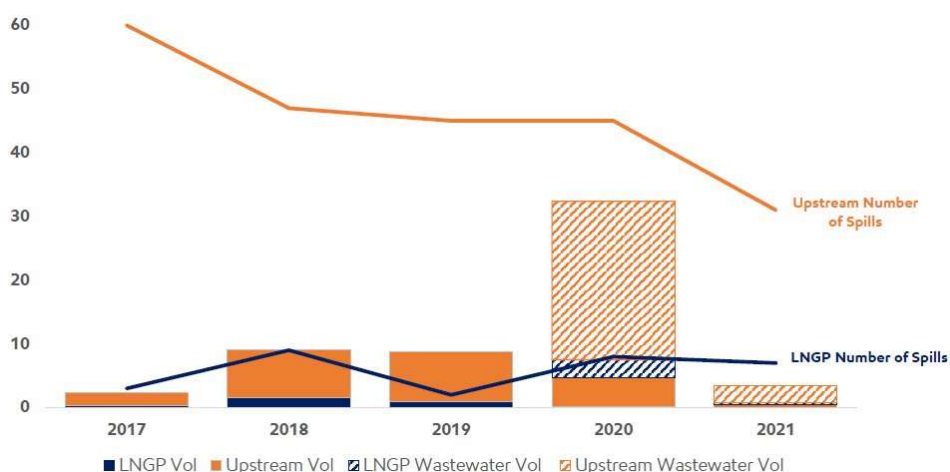


Figure 3.1: EMPNG Spill Performance

There were only two Environmental Compliance Incidents (ECIs) in 2021, both in the Upstream area (Figure 3.2). One was that HGCP Retention Pond S1 exceeded discharge criteria for Ammonia-Nitrogen at 1.1 mg/L (Discharge Criteria = 0.4mg/L) and this ECI is closed. The second was for vegetation clearance (including large trees) during helipad reinstatement outside approved 30 m construction footprint along the ROW. The incident investigation has been completed and the ECI remains open. Two carryover compliance issues from 2018 and 2019 were closed in 2021: the presence of invasive fish observed in the HGCP STP retention pond #3, and cane toads sighted at HGCP. Overall, EMPNG continues to do a good job of tracking incidents and non-conformances.

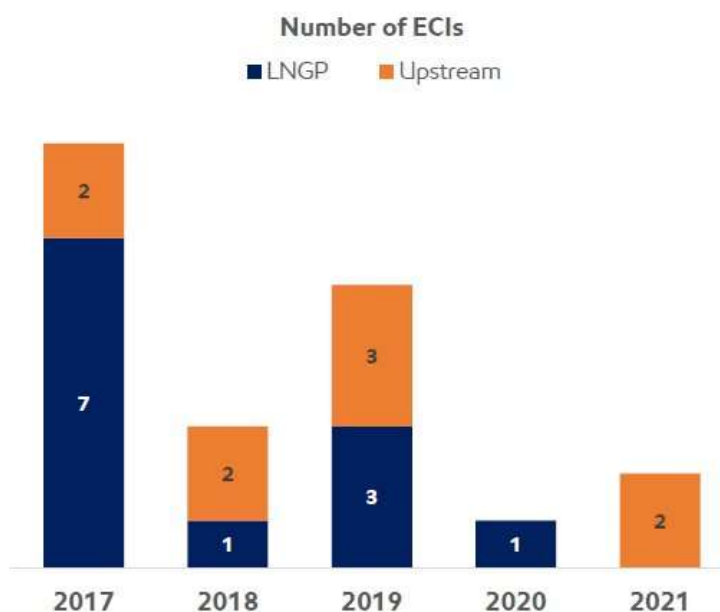


Figure 3.2: Environmental Compliance Incidents

4 POLLUTION PREVENTION

4.1 WASTE AND WATER MANAGEMENT

4.1.1 Project Strategy

EMPNG's objectives are to apply the waste management hierarchy (wastes will be preferentially and sequentially avoided, reduced, reused, recycled or recovered) and to dispose all wastes at EMPNG facilities and approved third party facilities only. EMPNG's objectives are also to avoid significant impacts associated with the release of pollutants to surface water and groundwater and meet applicable discharge criteria. These applicable discharge requirements are those tabulated in Chapter 9 of the Upstream and LNG Plant EMPs.

4.1.2 Observations

4.1.2.1 Waste Management

The amount of waste generated slightly decreased in the Upstream area and remained steady at the LNG Plant in 2021. The total project waste generation is shown in Figure 4.1, where the decrease relates to a reduced scope of work in the Upstream area and the continuation of waste reduction initiatives.

In the Upstream area a decision to operate the incinerator at the Hides Waste Management Facility (HWMF) at Kopeanda continues to be deferred until further notice. Only medical waste and animal carcass waste is being incinerated at the HWMF at the MediBurn facility. As a result, landfilling continues to be the main method of disposal, which is the main method across the entire Project (Figure 4.2).

In the Upstream area, landfilling is the most cost-effective solution to the disposal of non-hazardous waste. The Kopeanda landfill is 55% used and estimated by the Project to have >20 more years of life. Another option for Upstream waste disposal planned for several years is the OSL Waste Management Synergy (Southern Synergy Waste Initiative) whereby EMPNG and OSL share facilities and take advantage of the best disposal options offered by each company. As the commissioning of the incinerator at Moro Camp B has also been deferred until further notice, this Synergy is currently that the OSL incinerator continues to manage Moro Camp B incinerable general waste.

Waste management at the LNG plant reached the limit of what can be undertaken internally when the LNG Plant landfill reached 100% capacity in May 2021. In the interim, EMPNG is storing or incinerating waste that would otherwise go to the landfill and the remaining cell from the construction phase has been lined with geosynthetic and is awaiting commissioning for use (Figure 4.3). The LNG Plant no longer has incinerator capabilities and incineration takes place at the Total Waste Management (TWM) Roku facility. EMPNG has continued to support TWM in their development of an integrated third-party waste management facility. EMPNG plans to continue work with TWM Roku in 2022 to develop their restricted waste landfill, industrial wastewater treatment plant facilities, and restricted waste incineration. EMPNG has 89 tons of oily rags from Upstream pending incineration at the TWM restricted waste incinerator pending its passing emissions testing.

2022 plans for improving waste management include using carbon filters as pretreatment for wash water before reedbed release and then using the reedbeds for onsite final treatment, reusing the HGCP Chatoyer laydown area as restricted waste storage site, commissioning a Thermal Treatment Unit for treatment of drilling waste stored at HQ1, and using spent molsieves as day cover for LNG Plant Construction Cell C operations. EMPNG is currently in the process of evaluating/revisiting their 30-yr waste strategy for further optimization.

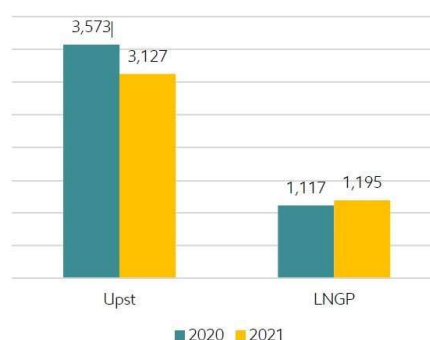


Figure 4.1: 2021 Total Project Waste Disposal

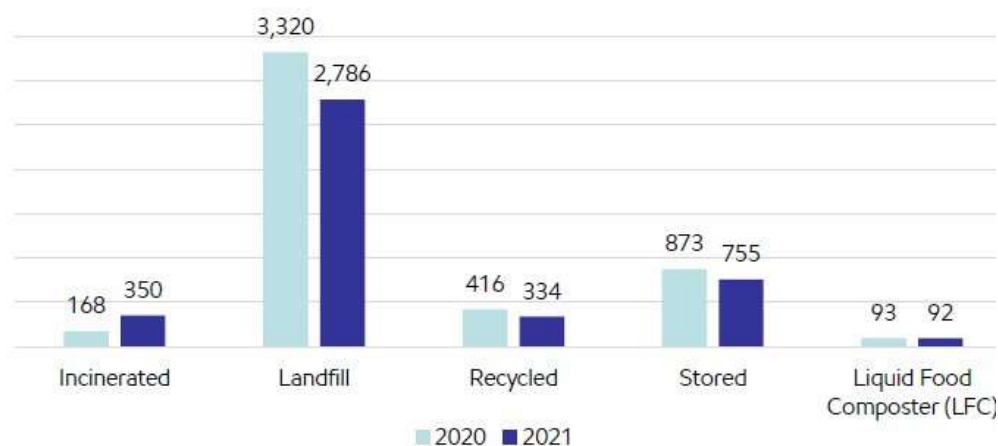


Figure 4.2: 2020 Total Project Waste Generation



Figure 4.3: New Liner at Construction Landfill Cell C

4.1.2.2 Water Management

A Level 1 Non-conformance (NC) was assigned to wastewater treatment in the 2017 IESC report. Improvements were made to the system and after some performance ups and downs the issue of wastewater management was closed in the Issues Table in the last IESC report from February 2021. With closure of this issue the note was made that careful management would be required to avoid the resurrection of a NC. IESC is pleased to note that water management continued to improve with only one Upstream STP-related NC and one STP-related NC at the LNG Plant. Improvements can be attributed to CEPA approval to use onsite labs for compliance and verification monitoring, as well as assigning personnel dedicated to operation and maintenance.

Upstream

In the Upstream area there has been generally good STP performance:

- ✓ Moro and Angore STPs recorded zero exceedances of water quality against discharge water quality guidelines;
- ✓ HGCP STP continued a generally good performance in 2021 with minor excursions of ammonia-nitrogen and BOD from the STP reflected in a minor exceedance of ammonia-nitrogen in the retention pond downstream of the STP (1.1 mg/L vs a standard of 0.4 mg/L). This was classified as an ECI as discussed in Section 3.3.

Replacement of new flow meter for sludge transfer pump and new mixed liquor suspended solids (MLSS) probe analyzer at the HGCP STP have ensured pumps are working well and potential sludge build up is quickly identified.

There have been no exceedances of ammonia-nitrogen and BOD since these fixes were made. Discharge criteria for Total Suspended Solids (TSS) were not always met at the discharge point of the HGCP retention pond in 2021, but with the monitoring and maintenance of the silt/sediment control devices along the stormwater drainages this situation has not carried over into 2022.

Groundwater monitoring around the HGCP shows no evidence of groundwater contamination. Conversely, at the Hides Waste Management Facility (HWMF), evidence of infiltration of leachate from the facility has been recorded since 2014. Monitoring events in May and November 2021 continue to show anomalous barium, iron, cobalt, calcium, magnesium, sodium, nitrogen and ammonia, and one case of fecal coliforms in wells either downgradient or side gradient from the HWMF. Three new groundwater monitoring wells (Figure 4.4) were installed in 2021 around the Hides Waste Management Facility (HWMF) to give improved upgradient and downgradient coverage. The data collected from the new wells indicate that anomalous chemical concentrations suggestive of landfill leakage are most likely of natural origin, but these wells still exhibit some anomalies that are not easy to interpret. For example the measurement of pH values of 12.4 and 13.35 from the new Well 5a is not natural, nor possible from drilling through limestone. Additional sampling and analysis from all of the wells is necessary to better understand groundwater conditions around the HWMF. The IESC recognizes that impact to the nearby Tagari River is probably negligible and there are no users of groundwater in the neighborhood of the HWMF.



Figure 4.4: New Monitoring Wells (in blue) at HWMF

LNG Plant

The LNG Plant Toray STP had generally exhibited good performance in 2021. The plant had a single excursion of TSS due to a faulty filter membrane in the membrane bioreactor tank with no impact to the receiving environment. The Unidro STP was not operational in 2021. An issue with the air diffuser line in the aeration tank was identified during commissioning and the unit is targeted to go online in 2022.

The management of wastewater at the LNG Plant has also benefitted from CEPA approval to use onsite labs for compliance and verification monitoring. As noted in the last IESC report, on January 18, 2021, CEPA approved ending the monitoring of amines in plant discharge water as for 20 months amines had not been detected in the retention pond, mixing pit (point of compliance) and tidal flats (outside fence).

The only non-conformance with respect to surface water in 2021 was discharge from the retention pond where pH discharges were not met due to algae bloom events (which typically occur post-rainfall events when nutrients loads are high), while pond remains stagnant with limited flow and flushing. Brine discharge from desalination plant was re-diverted into pond as per design to ensure sufficient volume and flushing in preventing stagnant water inside the pond and this issue has not carried through to 2022.

The groundwater monitoring network (Figure 4.5) surrounding the landfill at the LNG Plant has identified some anomalous measurements of barium, selenium, manganese, iron, and a range of other analytes (e.g., zinc, iron, calcium, magnesium, nitrate, nitrogen) without identifying an obvious plume in the groundwater where westward flow towards Caution Bay would be expected. A third-party review of the test data confirms the complexity of the distribution of anomalous concentrations of analytes outside of relevant permit criteria but does not identify the landfill as a definitive source. The study notes that local groundwater is saline and therefore not a resource but

recommends improvements to the monitoring network and sampling procedures to assist in understanding potential sources of the elevated analytes in the groundwater and assessing the adequacy of the coverage provided by the groundwater monitoring network, relative to the risk posed to downgradient groundwater receptors.

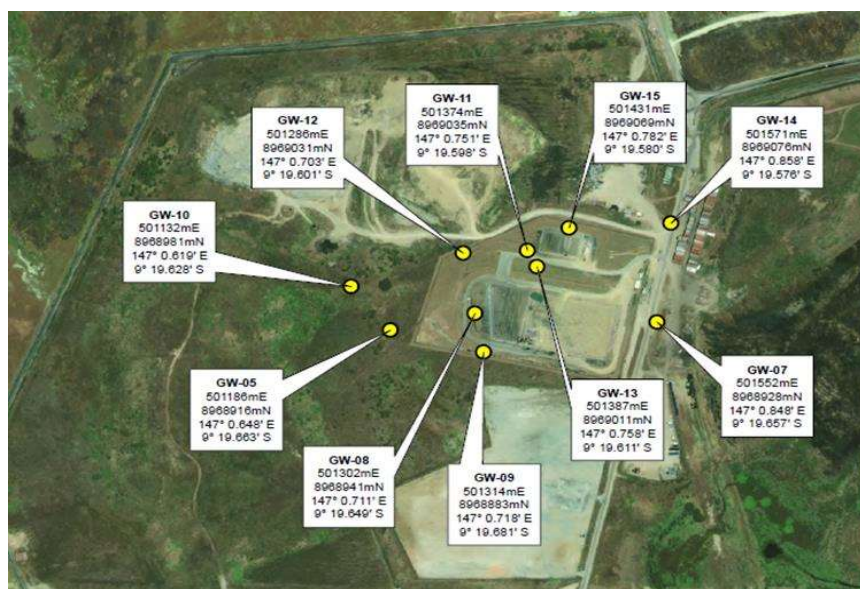


Figure 4.5: Monitoring Wells at LNG Plant Landfill

4.1.3 Recommendations

1. Continue monitoring around both the HWMF and LNG Plant landfills until defensible conclusions can be reached regarding leakage. If there is evidence of leakage undertake a fate and transport analysis of the contaminants.

4.2 HAZARDOUS MATERIALS MANAGEMENT AND SPILL PREVENTION

4.2.1 Project Strategy

EMPNG's objectives are to prevent spills of hydrocarbons and chemicals and to respond effectively to spills should they occur. EMPNG also has standards for materials management where objectives are to avoid significant impacts associated with the procurement and use of raw materials and to use materials that are less hazardous or otherwise preferable from an environmental perspective, where practical.

4.2.2 Observations

Spill prevention continues to be effective. As discussed in greater detail in Section 3.3 of this report, there were no Corporate reportable spills (>1 bbl) in 2021. The verification of hazardous materials management practice is something that requires field observation, which could not be undertaken for this review, but this is not an issue that the IESC has ever identified during the Production phase of the PNG LNG project.

4.3 AIR QUALITY AND NOISE

4.3.1 Project Strategy

EMPNG's objectives are to avoid significant impacts associated with the release of pollutants to air and meet applicable emissions and air quality criteria. Requirements for noise control are those identified in the IFC General EHS Guidelines.

4.3.2 Observations

The past year saw a setback with respect to flaring at the LNG Plant and a fairly constant performance at Hides (Figure 4.6). The increase in flaring at the LNG plant was the result of an unplanned power outage at OSL Kutubu CPF with the result that 2021 flaring was 1,472 MMscf vs. 556 MMscf in 2020. If we look at flaring in terms of total project emissions based on ktons CO_{2eq}, flaring represented 6.9% of emissions, but it should be recognized that during normal operations flaring represents less than two percent of project air emissions with 90% originating from turbine generators.

To determine the quality of the main emissions, stack testing was undertaken in 2021. All testing was conducted either at turbines or generators, as EMPNG no longer operates incinerators. At the LNG Plant all 17 sources (10 compressor turbines and 7 gas turbines) were found compliant. At HGCP three pipeline compressor turbines were found to be compliant, but two out of three gas turbine generators tested (the third was offline and awaiting repairs) failed for NO_x (the standard is 42 ppm and concentrations of 43 and 48 ppm recorded). NO_x emissions are controlled with SoloNox technology, which does not kick in until load capacity is >50% and the gas turbines are currently operated at <35% load capacity. EMPNG is looking at ways to improve performance and follow-up testing is planned to be conducted in mid-late 2022 with corrective action undertaken by the engineering team and vendor (Solar Turbines). If corrective actions don't resolve the NO_x exceedance, EMPNG may consider proposing to CEPA and Lenders for a possible review/visit of the NO_x criteria on Hides Gas Turbine Generators. The next full round of emissions testing is scheduled for 2024. EMPNG continues to review opportunities to further reduce emissions per ExxonMobil's 2030 Emission Reduction Plan (ERP).

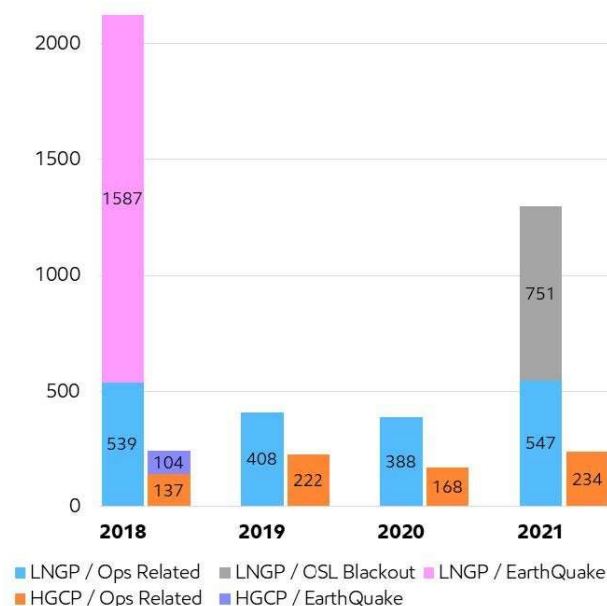


Figure 4.6: Flaring 2018 - 2021 (MSCF)

Noise monitoring was undertaken in 2021 with no problems to report, including at Moro X where baseline noise levels were established in 2020 and also at Angore Wellpad C (completed in 2021). Vibration monitoring was also conducted in January 2022 in association with pile driving at Wellpad C with results within generally accepted international standards.

EMPNG also tracks emissions in terms of greenhouse gasses (GHG). As previously noted, most emissions are from the turbine drivers and generators (Figure 4.7). IESC is not in a position to evaluate the efficiency of the various systems producing emissions but has been informed by the Independent Technical Consultant (ITC) that they have world-class efficiency.

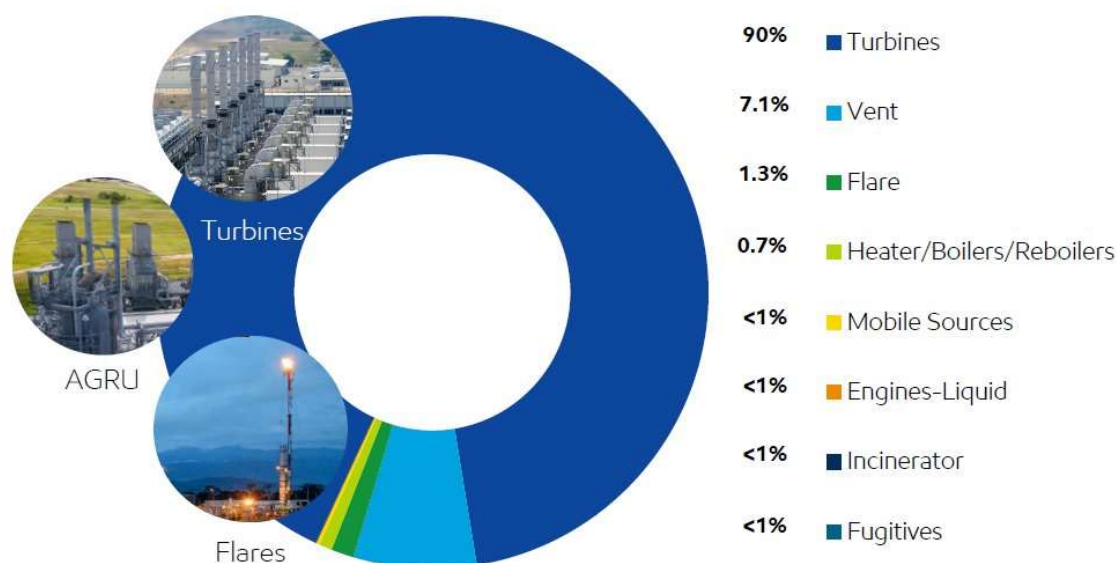


Figure 4.7: 2020 Project Emissions by Component

In terms of overall GHG emissions (Figure 4.8) the Project has produced about 2,000 kilotons per year since the start of Production. As perspective, total emissions are roughly comparable to a single 375 MW commercial thermal power plant. Working in accordance with ExxonMobil corporate objectives to reduce overall corporate emissions by 20%, EMPNG plans to focus on reducing flare emissions, running one pipeline compressor instead of two, and recommissioning fuel gas compressor at the LNG Plant, with other opportunities yet to be determined EMPNG is evaluating emission reduction opportunities consistent with ExxonMobil's 2030 Emission Reduction Plan.

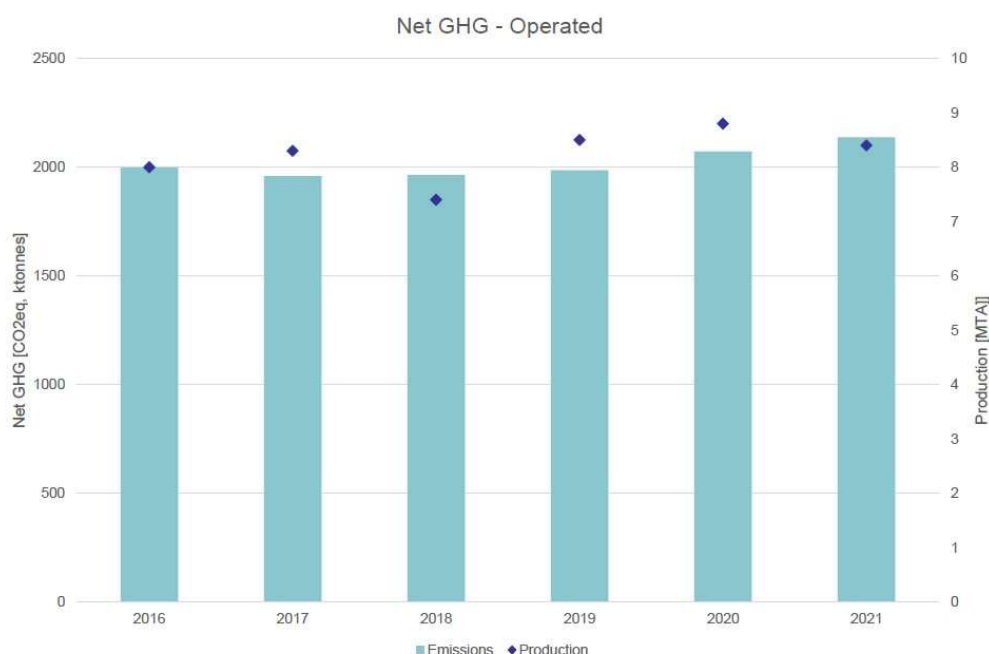


Figure 4.8: Project GHG Emissions

4.4 EROSION AND SEDIMENT CONTROL

4.4.1 Project Strategy

EMPNG's objectives are to control significant erosion and prevent sedimentation of surface waters.

4.4.2 Observations

The earthquake caused some serious problems with respect to slope failures in the Upstream area, including at the wellpads and spinline, Komo airfield, and along the pipeline right of way. Repairs and remediation appear to have been underestimated. In January 2019 costs were estimated to range between \$295 and \$410 million for repairs to these components with completion projected for August 2021. In February 2022 completion is projected for May 2025 and \$344 million has been spent to date out of a total forecast of \$563 million. In spite of the unexpected difficulties, recovery continues to progress effectively.

All repairs at Well Pads and Spinline; including Wellpad D (WPD) major landslides, WPD cable relocations, piping repairs, Liquid Mud Plant storage tanks, etc. are complete.

The work at Komo was defined in a Komo Drainage Erosion, Sediment, Reinstatement Plan (ESRP), the contractor's EMP, with several components undertaken within four Zones (Figure 4.9):

- ✓ Vegetation clearing and topsoil management, including the use of silt fencing and lightly harrowing slopes and batters to provide roughened surfaces that will enhance topsoil retention and minimize lamination and erosion; and
- ✓ Construction of temporary and permanent erosion and sediment control measures including cross
- ✓ contour surface drains (berms), Turf Reinforced Matting (TRM), jute mats, check dams (from coir logs), silt fences, filter berms, rock rip rap, gabions, reno mattresses, hydro-seeding, and sediment traps.

These various components break down into two basic tasks, drainage control and revegetation. Construction of a permanent drainage system and revegetation at the Komo airfield was completed in September 2021 with a soil ameliorant applied in December 2021 to assist the revegetation. The effectiveness of the permanent drainage controls will need to be evaluated over time, but the system looks to be a permanent solution to an endemic problem.

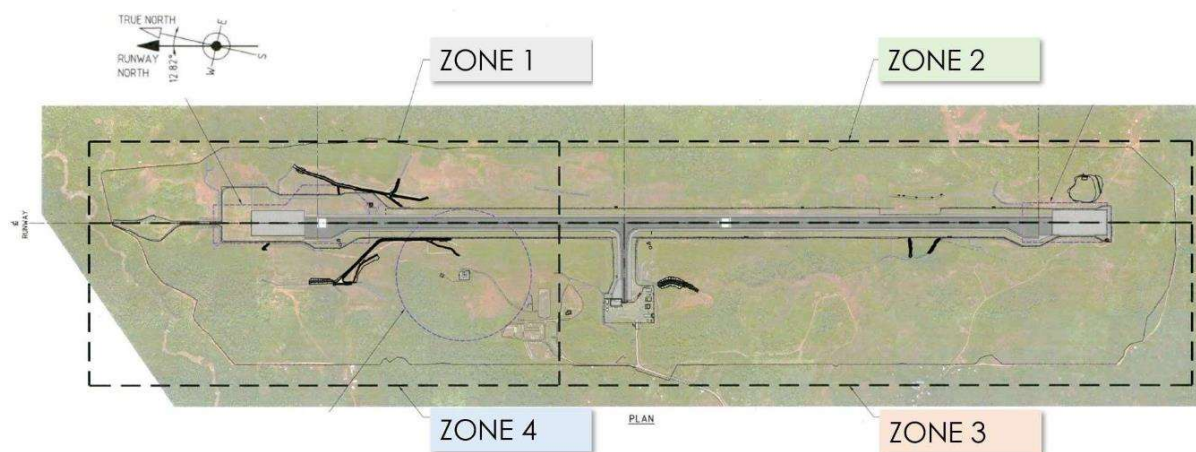


Figure 4.9: Work Zones at Komo Airfield

The success of the system now rests with the implementation of the Erosion and Sediment Control Plan (ESCP) which is one of the Project-specific Construction Environmental Management Plans (CEMP). Key aspects of the ESCP are a dedicated team were responsible for daily observations of ESC and environmental inspections are done weekly, however all site personnel participated in observations and interventions to maintain the erosion and sediment control measures. A Long-Term Monitoring and Maintenance Plan within the context of a "Drainage and Erosion Maintenance Strategy" will also be implemented.

The best means to depict the level of effort taken for erosion and sediment control at the Komo Airfield is through photos (Figures 4.10 through 4.14).



Figure 4.10: Zone 1 - Sediment Retention Structure



Figure 4.11: Zone 1 Drain 5 Completed



Figure 4.12: Zone 2 Landslip Stabilization

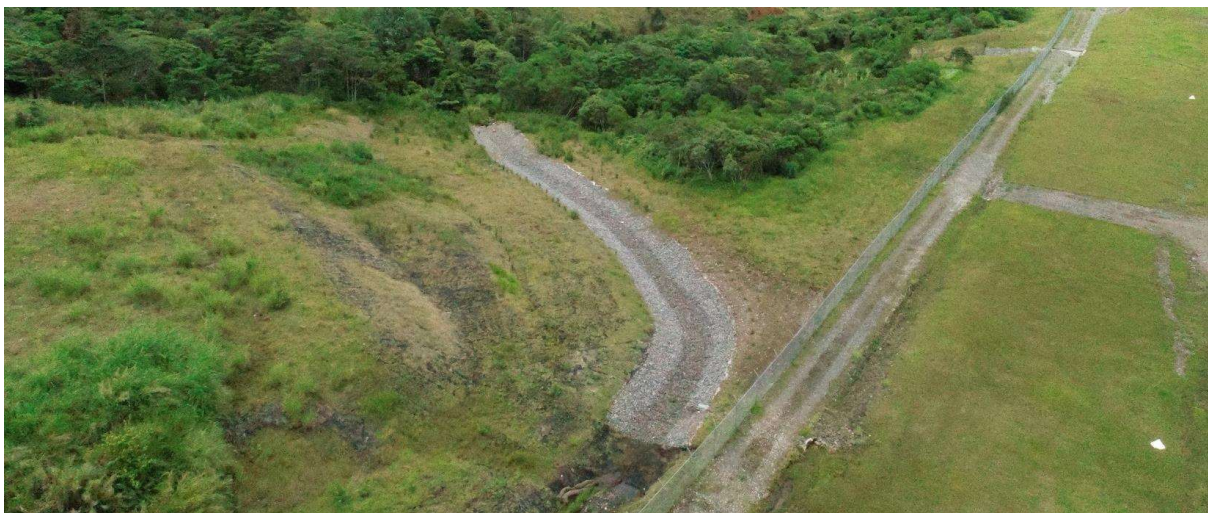


Figure 4.13: Zone 3 Drain 17 Complete



Figure 4.14: Zone 3 Drain 18 under Construction



Figure 4.15: Zone 4 Drains 1 and 21



Figure 4.16: Zone 4 Out-of-Drain Vegetation

Pipeline repairs also relate mainly to issues of erosion and sediment control and 6 of 29 repair sites have been completed. The completion of the Moro Camp expansion in 2021 is now facilitating access to the pipeline right-of-way. As described in greater detail in the last IESC report, some of the most difficult slope stabilization is required where the pipeline traverses the crest of a ridge where the ridge slopes are unstable. In such cases a unique solution has been developed whereby the ridge crest over the pipeline is stabilized by micropiles. Figure 1.3 shows an example of micropile operation.

5 BIODIVERSITY AND ECOLOGICAL MANAGEMENT

5.1 INTRODUCTION

This section provides an updated record of IESC Observations and Recommendations associated with EMPNG's ecological management (both terrestrial and aquatic) including: implementation of the Biodiversity Strategy and related monitoring of areas potentially impacted by the project; the ongoing development and implementation of the biodiversity offset program (to address residual impacts); the reinstatement and regeneration of areas previously and newly cleared by the Project (including pipeline Right-of-Way (RoW), construction camps, quarries, etc.); the management of issues related to invasive species, pests and plant pathogens (including quarantine management of imports); and the avoidance of project-related induced access resulting from the construction/upgrade/retention of roads, tracks and the pipeline RoW corridor.

The Project chooses to continue alignment with the 2006 version of the IFC Performance Standards, and as such, the whole Upstream Project area is deemed to be Critical Habitat – as such, no net loss (NNL) of biodiversity remains a key deliverable in relation to significant residual impacts. EMPNG's approach to biodiversity and ecological management is described in the Biodiversity Strategy, the Biodiversity Implementation and Monitoring Plan and Production-phase EMPs, along with other associated documents.

Records from the EIS baseline studies and the Pre-Construction Surveys (see previous IESC reports for background) serve to establish the ecological conditions prior to ground disturbance/clearance or infrastructure development. These records include information on the presence and distribution of invasive species, and the locations of focal habitats and ecological sensitivities such as (but not restricted to): pinnacles that contain bat colonies; potential Bulmer's fruit bat (*Aproteles bulmerae*) colonies; bird-of-paradise and bowerbird display grounds and trees; large individual trees (>1m diameter breast height); areas of Pandanus swamp forest; swamps in sinkholes less than 50 m deep on Hides Ridge; and *Nothofagus* (beech) forest that will require special hygiene measures (due to risk of dieback as caused by pathogens such as *Phytophthora cinnamomi*). These detailed records have been compiled into a Register of Focal Habitats and Significant Ecological Features. This Register is being supplemented by information related to post-construction and current ecological conditions through ongoing monitoring studies and surveys.

5.2 BIODIVERSITY STRATEGY & IMPLEMENTATION

5.2.1 Project Strategy

EMPNG's commitment is to safeguard biodiversity in areas where the company operates and in particular, the biodiversity values in the Upstream area. The Biodiversity Strategy was developed to guide the long-term management of terrestrial and freshwater biodiversity within the Upstream area. The Strategy provides an overview of EMPNG's overall approach to mitigating impacts on biodiversity in alignment with the avoid, reduce, remedy, and offset mitigation hierarchy. The goal of the Strategy is to retain the biodiversity values of the Upstream Project Area on a regional scale for the long term. To achieve the overall goal, EMPNG's objectives are to:

- i. maintain the intactness of the Upstream Area as a whole;
- ii. conserve priority ecosystems;
- iii. protect focal habitats; and
- iv. identify, measure and offset significant residual impacts.

In order to achieve these objectives, avoidance, mitigation and monitoring of biodiversity values takes place at three levels:

- ✓ the large scale, which is the entire Upstream Project Area – biodiversity values at this scale include extensive intact forest, high levels of flora and fauna diversity and endemic species, unique assemblages of species, species of conservation concern, and biodiversity of importance to local communities;
- ✓ the medium scale, which is represented by particularly valuable areas referred to as 'priority ecosystems', including forests in the Hides Ridge and high-altitude Homa-Benaria Ridge areas, the Lake Kutubu area and forests in the Juha area; and
- ✓ the small local-scale, which are sensitive habitats referred to as 'focal habitats' and significant ecological features; these include caves and pinnacles, sinkhole swamps, upland streams, stream refuges in unstable landscapes, lowland rivers in stable landscapes, off-river waterbodies, flora/fauna/habitats of cultural significance and lekking trees/grounds.

To ensure that implementation of the Biodiversity Strategy is effective, the Biodiversity Implementation and Monitoring Program (BIMP) assesses on the ground performance against the following five Key Performance Indicators (KPIs):

- i. intactness of forest;
- ii. trends in species diversity and abundance;
- iii. conditions of focal habitats;
- iv. occurrence of invasive species/pathogens; and
- v. offset gains.

Four Programmed Monitoring Activities (PMAs) are used to collect information for analysis against these KPIs:

- ✓ PMA-1: remote sensing² of broad-scale land cover, designed to monitor forest loss, land use change and degradation in the Upstream Area as caused by impacts that are directly Project-related, indirectly Project-related (third party, induced), non-Project (third party, expansion of pre-existing activity), and/or natural change (e.g., landslide);
- ✓ PMA-2: 'condition' surveys of focal habitats and significant ecological features adjacent to and in the vicinity of the pipeline RoW, facilities and other infrastructure;
- ✓ PMA-3: species specialist-led biodiversity surveys, designed to collect and analyze priority flora, fauna and ecosystem data both in/around areas affected by the project and in protected areas enhanced and/or established through the offset program. Areas of focus for these surveys have been Hides Ridge (termed site BAA1) and Agogo Range near More (BAA2) which have been surveyed during 2015, 2017, 2019 and 2021. The 2017 surveys also covered additional areas at Wau & Uro Creeks in Lower Kikori, plus non-aquatic aspects of Lake Kutubu; and
- ✓ PMA-4: to assess the efficacy of the various components of the biodiversity offset program, and to establish, over time, EMPNG's progress with respect to achieving>NNL of biodiversity.

In addition, three Environmental Management Plan (EMP) Protocols are used to inform the KPIs. IESC observations on their implementation are provided in sections of this chapter:

- ✓ Access Control: the protocol formalizes the monitoring of vehicle access to and along PNG LNG project roads and infrastructure to prevent potentially damaging third party activities resulting from access;
- ✓ Regeneration Monitoring: the protocol formalizes the collection and analysis of information relating to the regeneration of temporary work areas disturbed during construction and evaluated against established benchmarks; and
- ✓ Invasive Species and Plant Pathogens: the protocol formalizes monitoring of the occurrence and distribution of invasive species, pests and plant pathogens, and provides guidance on remedial actions.

EMPNG will evaluate monitoring results gathered via the various PMAs and EMP protocols, and depending on the significance of the findings, implement adaptive actions through management response.

To address residual impacts on critical habitat, and in accordance with the Biodiversity Strategy, EMPNG is implementing a Biodiversity Offset Program to ensure no net loss (NNL) in biodiversity. The program components include protected area planning, supporting the national biodiversity strategy, building conservation capacity, enhancing existing protected areas and establishing new protected areas.

EMPNG's Biodiversity Strategy (BS) and Biodiversity Implementation and Monitoring Program (BIMP) documents are publicly available for download at <https://pnglng.com/Environment/Biodiversity-management>.

5.2.2 Observations

Note: as for 2020 and 2021, this Feb 2022 review was undertaken through a desktop study. The IESC was unable to observe and discuss issues to the same extent as for pre-2020 reviews. The observations and opinion reported

² Landsat data was acquired for 2009, 2011, 2013 and 2015 periods for the entire Upstream Area (UA), and higher resolution RapidEye data was acquired for 2011, 2013 2015 and 2017 periods for a linear infrastructure (LI) corridor containing the PNG LNG RoW, facilities and all other infrastructure within the Upstream area. Landcover classification of 2019 data was primarily based on 10m Sentinel-2 imagery. A combination of imagery sources was used for the 2020 change analysis including Sentinel-1, Sentinel-2a, Sentinel-2b (Sentinel-2), and high resolution Maxar Imagery captured by WorldView satellites. Data from Sentinel-1 SAR (20m resolution) and Sentinel-2 (10m resolution) satellites was used for RPCM (Radar Persistent Change Monitoring) and Two-date Optical change detection, respectively

herein are based solely on presentations provided by EMPNG and documentation requested post-presentation. The IESC appreciates all the information provided to undertake this desktop review.

5.2.2.1 Biodiversity Strategy, Implementation and Monitoring Program

PS6 relevant Project incidents

Section 3.3 provides information on EMPNG's Environmental Compliance Incidents (ECI) and EMP Non-Conformances (NC). The two PS6-relevant ECIs noted in the last IESC report are now deemed closed. The Project advises there have been no further observations of introduced carp or tilapia at the STP at HGCP (and monitoring continues fortnightly). For the second closed incident, although cane toads are still prevalent at HGCP and HWMF, data reported for 2021 indicate their numbers are much reduced due to control measures introduced by the Project.

Information on two new, related PS6-relevant incidents was provided, from Sept 2021.

- ✓ During the reinstatement of construction-phase helipads to enable recent maintenance visits, there was vegetation clearance outside of the approved clearance zones. The service contractor engaged to reinstate the helipads (1) undertook non-approved clearing around a former helipad at KP284, as the site was not on the intended helipad reinstatement list, and (2) at two locations (KP 290 and again at KP284), trees and other vegetation were cleared outside of the zone approved to be cleared. Clearance of up to a RoW width of 59m occurred;
- ✓ A key learning is that site verification must be performed by EMPNG representatives prior to intrusive maintenance work.



Helipad at KP284 with trees cut down to max width of 45m, beyond approved 30m construction allowance



Helipad at KP290 with trees cut down to max width of 59m, beyond approved 30m construction allowance

Figure 5.1: Views of Tree-Felling Incidents

Biodiversity Monitoring Program

EMPNG has restructured the BIMP to differentiate between activities related to monitoring for residual impacts, and those related to offset programs. PMA summaries have been amended to reflect changes made to field programs and the updated PMA Protocols. The IESC endorses this restructured update and will separately provide a few recommendations. We do note there could be more mention of how stakeholders (other than community and government) are being or will be engaged, such as national/international conservation non-governmental organizations (NGOs), as was recommended in the EIS. According to good international practice, this is especially key for residual impacts and biodiversity offset programs. The Business and Biodiversity Offset Program (BBOP) principle states: "In areas affected by the project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, implementation and monitoring." The IESC encourages the Project to seek engagement with conservation NGOs which will help provide additional transparency to the residual impact and offset programs.

Monitoring campaigns have continued on a one/two-yearly cycle as noted in previous reports, and PMA updates are provided in the following paragraphs.

PMA-1 Remote sensing update: At the time of this desktop review, 2021 data is being analyzed by EMPNG's external specialist contractor, representing the 2nd of the 3 years of annual change monitoring, building on the

previous 2-yearly analyses. The Project is currently discussing an extension to the Contractor's scope of work so that changes in habitat condition can be assessed, to indicate potential biodiversity gains for the offset program.

The analysis of 2020 data (completed 3Q 2021) indicated six separate locations across the Upstream area where land use change was in close proximity to the PNG LNG area of influence. The external contractor noted a number of these land cover changes as habitat degradation and clearing of forested areas and EMPNG recommended further investigation to identify whether these were potentially residual Project-related impacts. Follow-up inspection occurred during Jan/Feb 2022 by EMPNG personnel, via on-the-ground visits or observed from chopper or drone flyovers. The 6 locations were:

- ✓ G1 – near Mainline Valve 1. These change features can be characterized as a mixture of degradation and clearing of forested area;
- ✓ G2 – near Angore Wellpad B and Anguale. A new ~6 ha clearing was also identified in Anguale;
- ✓ G3 – Two change areas identified adjacent to existing road along/near the PNG LNG proximity buffer ~1 km North of Moro Camp;
- ✓ G4 – Two change features collectively totaling ~1 ha were identified near Cathodic Protection Station 1;
- ✓ G5 – Two change polygons totaling ~1.3 ha were identified directly SW of Gobe Airfield;
- ✓ G6 – Four change polygons each between 0.5-2 ha indicate clearing of forested area near the Kopi Shore Base and settlement.

They are in the vicinity of PNG LNG infrastructure (sometimes overlapping with it), and some are in areas where previous forest loss/land use change/degradation has been observed. Following inspection, the loss of forest and change in land cover for all six locations was classified as 'anthropogenic, human settlement and garden,' and as such, not attributable to the Project.

During discussions with the Project for this review, it became apparent that the Project is not classifying instances of observed change as Project-attributable even though they could potentially be the result of indirect and residual impacts. Only changes related to direct Project impacts such as installation of new infrastructure, are being considered as Project-attributable. Of course, local landowners have the right to clear their land but when this is in direct proximity to the pipeline RoW or infrastructure, and therefore access to those areas newly cleared may have been enhanced by the presence of the Project (as noted by the authors of the 2019 PMA3 survey report), this should be acknowledged.

As already flagged in previous reports, the IESC now strongly recommends EMPNG reconsider how they distinguish whether an observed clearance/forest cover loss event is potentially attributable to the Project when this is done by the community (related to Section 8.2.7 of PMA1 Protocol). In the IESC's opinion these could potentially be categorized as indirect impacts attributable to the Project. That EMPNG continues to report no indirect Project-related change following ground-truthing needs further consideration. The database cataloguing all previous observations requiring follow-up inspection should be checked with this in mind. The IESC appreciate this is not always easy to determine, but further consideration of indirect impacts is warranted. This is noted as a new Observation in the Issues Table, Section 2. Note: this will not necessarily have implications for the offset target due to the scale of the notional gain targets to be reached.

PMA-2 Visual observations of 'condition' of sensitive sites avoided by the Project but potentially affected due to their proximity to Project RoW, Project roads and access by communities: The 2020 PMA2 field surveys were postponed due to COVID-19 restrictions, however, twenty focal habitat sites and ecological features were visited in 2021. These sites include caves, streams and creeks, swamps, important habitat area and some sites where dieback was previously noted.

The Project advises that the natural regeneration of focal habitat and sensitive sites visited has continued, with a number of sites inaccessible due to regrowth. Monitoring of all sites remaining on the PMA-2 will continue, due to their proximity to RoW access roads and community presence.

PMA-3 Biodiversity survey updates: The most recent surveys were undertaken during Jul 2021, again at Hides Ridge (6 transects) and Agogo Range (4 transects) in the vicinity of Kutubu MLV (KP107) and Arakubi, near Oil Search's Ridge Camp, Moro. The resulting report is not yet available (will be completed later in 2022) following field specimen and data analyses. Due to Covid-19 travel restrictions, for the first time a wholly PNG-national survey team was deployed; the Australian-based scientific team leaders assisted virtually during the four weeks of survey during 2021, having been mentoring the PNG team members in previous years.

After proving their feasibility and value in previous surveys, camera traps are being used for detection and identification of not only ground-dwelling mammals, but also birds.

It is worth noting the record number of rodents observed on Hides Ridge during the 2021 field study. None of the individuals captured were introduced / invasive species. This is in contrast to the 2019 survey when fewer overall numbers were recorded but 4 individuals of the invasive *Rattus exulans* species were captured (out of 40 individuals) in locations closest to the forest boundaries of disturbed areas. The ecological implications of this will be provided by the PMA-3 specialists in their forthcoming report.

In response to questions, EMPNG stated that the potential dieback on Hides Ridge noted during the 2019 PMA3 surveys had not yet triggered any sampling to confirm this or determine the type of dieback present. Dieback is caused by the plant pathogen, *Phytophthora cinnamomi*, and *Nothofagus* trees as seen on Hides Ridge are particularly susceptible. EMPNG states that photographs taken of the potential dieback during the 2021 surveys have been forwarded to the scientific team leaders for their visual assessment. The IESC recommends more urgency in EMPNG's approach in alignment with EMP requirements – see Section 5.5.2.4 for further discussion and a new Observation in the Issues Table Section 2.

A recommendation from the 2019 PMA3 report was to better understand the observed threats from increased hunting pressure and feral dog predation (as captured by camera traps). EMPNG has acted on that recommendation through the development of a pilot hunting questionnaire to better understand hunting characteristics of communities where evidence of hunting evidence was noted during those 2019 surveys. Engagement with communities, especially with those around Hides are reported to be providing the opportunity to discuss priority biodiversity and their values in the landscape, aligning with the new offset work in the montane elevation.

EMPNG advises that the PMA-3 Protocol detailing survey methodology and approaches will be updated during 2022 for use during the next scheduled surveys in 2023.

The IESC recommend the PMA-3 survey reports from the 2017 and 2019 missions be published on the PNG LNG website, alongside the earlier 2015 mission report.

PMA-4 Evaluation of the efficacy of the offset program, tracking progress in achieving>NNL of biodiversity: The updated PMA-4 protocol is now in use. The updated BIMP mentioned above gives an improved explanation of how each of the other PMA and EMP components align into EMPNG's understanding of residual impacts and therefore what compensation should be delivered through the offset program. EMPNG's current estimation of the offset debt is 5,357 hectares across the full Upstream area. The calculated debt required to compensate for that loss through offset currently stands at 17,410 hectares – 2,855 hectares in the lower elevation, 1,070 in the middle elevation, and 5,357 in the upper elevation. EMPNG also retains its 'notional target' of 50,000 hectares to be gained in each elevation zone which was developed in recognition of the assumptions used to determine the offset losses and gains. This larger notional target was based on a number of uncertainties and unknowns that informed early loss/gain calculations, including the ecological significance of edge effects along such a long linear footprint, whether mitigation measures could achieve desired outcomes, the scale of residual impacts, and background rates of forest loss, plus the challenges associated with implementing an offset program in PNG over a period of 30 years. Any realignment from the Project's notional framework target closer towards the calculated targets will require more certainty in these assumptions – hence the notional offset target of 150,000 hectares is retained.

Projected biodiversity gain trajectories derived from averted loss calculations were presented and compared with habitat hectare gain targets for each of the low/medium/high altitudinal zones. EMPNG notes that eleven Conservation Deeds are due to be formalized by 2023 (see Offset Component 5 below) which in theory would then indicate preservation of biodiversity values across a cumulative area of 31,848 hectares.

As mentioned in PMA1 above, the Project will shortly identify habitat condition within each of the elevation offset program areas, plus then start tracking positive/negative changes in habitat condition to inform loss/gain calculations. Best estimation averted loss will still be tracked but will be supplemented by condition data to assess loss/gain levels.

The Project intends to publish offset progress summaries every two years in the E&S Reports. It would be useful if offset loss/gain was also reported on an altitudinal band basis, presenting data and areas of averted loss (where land cover category has not changed), restoration/regeneration (where condition has improved) and degradation (where condition has deteriorated).

Freshwater Ecology

No update on freshwater ecology survey or sampling was provided during this review.

5.2.2.2 Biodiversity Offsets

Offset Program Design and Early Implementation

To achieve NNL, EMPNG's offset program combines both direct and indirect (enabling) components. The Company has provided the IESC with updates on each component:

Offset Component 1: Protected area planning. Support to the Conservation and Environment Protection Authority (CEPA) in meeting its international Convention on Biological Diversity (CBD) commitments via production of a 'Protected Area System Plan' for a Kikori-wide river basin (on World Heritage 'Tentative' list).

EMPNG considers this component complete with the publication of the 'Protected Area Planning for the Kikori River Basin' report written by WCS in 2017. They state the work has informed the identification of Project offset sites and protected areas established via Components 4 and 5 below. The Project did not have an update on the Government's progress for the Kikori Catchment as a UNESCO Cultural/Natural World Heritage Site, and the Kikori River Basin entry on the WHS website remains on the Tentative list dated 2006³.

Offset Component 2: Support the National Biodiversity Strategy and Action Plan (NBSAP). EMPNG's focus has been to support communication and networking initiatives.

Due to COVID-19, no Communicating Conservation meetings were held in either 2020 or 2021 and no newsletters were produced. Options for virtual meetings are being explored but would likely be challenging for remote communities and towns. The intention is that a new newsletter will be published in 2022.

Post-2020, the Project has reduced funding to this component of the offset program as planned, and they continue to actively seek co-sponsorship through collaborating organizations such as GEF and UNDP, so as to continue the communication and networking program. A specialist consultant previously engaged by the Project full-time (JMEC) has been further retained to assist in progressing the program. Prior to the pandemic, participants at previous meetings had expressed great appreciation for the networking provided at the meetings, as they allow small local and provincial conservation projects valuable opportunities to meet face-to-face with CEPA representatives and government ministers.

Offset Component 3: Enhancing Conservation Capacity Program (ECCP). EMPNG's support is focused on developing and institutionalizing Post-Graduate Diploma and Master's degree courses at University-PNG (U-PNG), providing scholarships, and establishing a framework for placements and mentorships with field-based conservation NGOs.

COVID-19 continued to affect progress and no conservation courses were conducted through 2020-2021. The U-PNG program in which four Master's Students were registered in 2018/19 was further deferred due to COVID, but also due to supervisor turnover at the university. JMEC (as above) has provided ongoing supervision and support. For 2022, the Project intends to engage with another long-term consultancy BRC to enhance the program for future students and proceed with the next stage of partnership and scholarships.

Offset Component 4: Support for existing protected areas. Enhancement of the Lake Kutubu WMA (Wildlife Management Area) is the primary focus for achieving this component.

Responding to IESC requests for more systematic reporting on progress in implementation of the Lake Kutubu Enhancement Program, the Project presented the following dashboard (Figure 5.2) which provides an improved summary of activity status. Of particular interest for this update is the engagement of a consultant to develop an update to the Lake Kutubu WMA Management Plan ("the Plan"). This Plan will be key to establishing the conditions for ongoing protection of the unique biodiversity values at the Lake Kutubu WMA and the IESC looks forward to receiving additional information on this important work as the Plan progresses.

Key to developing protected area management plans is the engagement with all stakeholders, seeking a wide-range of input, to build from previous management plans. The IESC flags the importance of broad external consultation for input into the Plan, that meets the needs of not only local communities but the wide range of national and international stakeholders that have a legitimate interest in this internationally important Ramsar site.

EMPNG has provided the undated Terms of Reference used to invite proposals to develop the Plan although did not indicate how widely the ToR was circulated. The ToR recognizes that stakeholder engagement needs to extend outside of the WMA, and briefly recognizes the international importance of Lake Kutubu. The ToR invites a detailed proposal on how the Plan will be developed (accepted proposal not seen). The IESC stresses the importance of the Plan being scientifically robust, based on up-to-date information, setting clear ecological and ecosystem service

³ UNESCO WHS available at <https://whc.unesco.org/en/tentativelists/5060/> accessed in March 2021.

preservation objectives and be well informed by a wide range of stakeholders' needs and opinions. Long-term engagement, adaptation and clear target outcomes are equally important, and it is encouraging that the Project states that IUCN protected area management plan guidance will be followed. The ToR contract was awarded and is being undertaken by a conservation biologist previously engaged by EMPNG for biodiversity field surveys and workshops / capacity building with the Lake Kutubu WMA Committee.

Lake Kutubu WMA Enhancement Program		Status
Workstream 1: Conservation Design and WMA Management Plan		
Stakeholder Engagement: WMA Committee	●	WMA Committee fully engaged in all activities
Stakeholder Engagement: Community	●	LKWMA Communities fully engaged in activities
Stakeholder Consultation: Other Stakeholders	●	Conservation community and PNG government (CEPA) had been informed through conservation meetings; SHP.
Conceptual Enhancement Plan	●	Completed - 2015; four programmatic areas: (i) Conservation (ii) Livelihood, (iii) Awareness, and (iv) Training
Environmental Awareness and Education	●	Completed and ongoing
Ecosystems Services Analysis	●	Work in progress – Ecosystem Services (Biodiversity and Cultural values)
Biodiversity Surveys	●	Completed in 2017, report published in 2018
Design and Development of Enhancement Program	●	Completed- 2012; The LKWMA Enhancement Program
Mapping	●	Work in progress- through WMA Management Plan Activities
WMA Management Plan [Update and enhance the existing Lake Kutubu Catchment Management Plan as part of a new Lake Kutubu WMA Management Plan]	●	Work in progress; 2021 – 2023 by consultant
Workstream 2: Enhance Organizational Capacity		
Training and Capacity Building	●	Training activities conducted over the years – e.g., conservation science, livelihoods training (poultry, crop rotations etc.)
Structure and Composition of WMA Committee	●	Completed
Registration of the WMA Committee and Lake Kutubu Foundation	●	Completed - LKWMA Inc.
Promises	●	Completed - Resource Center built
Equipment	●	Completed along with Resource Center
Communication	●	Out Board Motor Boat delivered – for communication and logistics across the Lake communities
Workstream 3: Local and Provincial Level Government Planning		
Stakeholder Engagement: Local Government	●	Ongoing; to be further progressed – more engagement planned with WMA Management Plan consultations
Stakeholder Consultation: Provincial Government	●	Ongoing; to be further progressed - more engagement planned with WMA Management consultations
Inclusion of WMA Management Plan in Ward Development Plan, Local Government Plan, Provincial Plans	●	Pending; to be further progressed - LLG Members (councillors) already involved at community level. More engagement planned with WMA Management Plan consultations

Figure 5.2: Lake Kutubu WMA Enhancement Program Status

For the Lake Kutubu WMA Management Plan to be adequate and reflect a sound 'status-pressure- response' approach, a thorough baseline of all priority biodiversity is necessary. The status dashboard in Figure 5.2 indicates that PMA3 biodiversity surveys were completed in 2017, and the resulting report published in 2018 – however these surveys did not study aquatic species. Oil Search Limited previously commissioned fish surveys and in 2014, a specialist fish composition and health survey highlighting the threats to (and vulnerability of) the endemic species within the lake. This study pointed to a number of management strategies to limit the consequences of introduced tilapia on endemic fish populations and recommended continued use of eDNA and follow up annual surveys. It is not clear whether eDNA or follow up annual surveys have been undertaken.

Therefore, the Observation raised in 2020 on the exclusion of aquatic ecology remains current, to highlight the need for up-to-date status information on all of the Lake Kutubu WMA biodiversity values being available to inform the Plan's objectives and targets. As EMPNG infrastructure is located within a legally protected area, from a PS6 perspective, the Plan should be representative of the aquatic conservation objectives of the lake and EMPNG's Biodiversity Team should be cognizant of that.

A presentation shared following the IESC calls presents a high-level summary of outputs from a community survey of environmental and social values undertaken late 2021. The summary notes the focus of the survey as mapping the location and extent of land-use values. The work being done by EMPNG with Lake Kutubu communities is highly valuable, but again, the biodiversity values related to aquatic ecology do not appear to be fully considered. EMPNG has always stated that freshwater values do not form part of their offset program, but they state that if the WMA Committee chooses to include fish conservation and monitoring activities in their work plan then EMPNG will support it. During IESC conversations with the WMA Committee in 2017, it was clear that health of the fish in the lake was of great importance to the Committee. However, when EMPNG community surveys of E&S values that will inform the Plan focus only on land-use values, it is challenging via remote desktop review to ensure that aquatic values are being effectively considered.

During 2021, the WMA Committee continued to pursue various livelihood activities as part of the grant funding they were awarded from the UNDP GEF-Small Grants Program reported previously. This includes poultry-keeping good practice, improved agricultural practices, waste management and signage to help identify no-go fishing zones.

In their 2022 Outlook for Lake Kutubu, in addition to work on the Plan as above, EMPNG states they are undertaking GPS training for community members to aid clan boundary mapping for conservation areas and also undertaking village/clan awareness and consultation workshops for a new potential protected area to the west of Lake Kutubu WMA. The high-level sketch map presented indicates part of the proposed area to be in the vicinity of the PMA3 surveys around Ridge Camp. This initiative is still in the early discussion phase and the IESC looks forward to further information once this has been further considered.

Offset Component 5: Establishing new protected areas.

At the Lower Elevation Zone (0-600m), EMPNG's intention is to enable the creation of a new community-based, regionally gazetted protected area (legal term, a Community Conservation Area) in the vicinity of the existing Neiru (Aird Hills) WMA. This will require the establishment of a Lower Kikori Resource Use Management Plan (LKRUMP), which will help offset residual impacts on biodiversity values affected in the Project's lower elevation footprint. To achieve this, EMPNG is working with former Bargaining Route Waterways Committee members, the Aird Hills WMA Committee, and a growing number of communities in the Lower Kikori. The Project supports a coordinator (sometimes based in Kikori Station) to assist with support to the communities and the lower elevation offset program.

EMPNG's program updates for 2021 report a new Sept/Oct 2021 engagement which now supports a total of 17 villages (representing 20 communities) who have worked through the initial natural resource mapping process. Of the 18 Conservation Deeds that are planned to enable protection of conservation values across the delta, 11 of these have now reached a stage where they be formalized. The Project reports that tribes and clans are now driving conservation themselves, encouraging even more communities to engage in the process; two new communities at Kopi and Kaiaam joined the conservation movement in 2021. There is active participation and interest from young fishermen in the area, which indicates a shifting dynamic in the younger generation replacing the elder-only previous engagement. The Project plans to return to two engagement visits per year and notes that sustained presence is key to maintaining momentum with communities in the Lower Kikori. A new contractor has been engaged to guide the communities through the process with an extendable one-year initial scope of work.

The Upper Elevation Zone (montane >1200m) represents the largest proportion of the overall residual biodiversity impact for the Project. Therefore, the biodiversity gain required is greatest at this higher altitudinal zone, through the creation of ecologically comparable areas managed for biodiversity.

The IESC can finally report some early progress in EMPNG's montane offset program. The Project has deployed a biodiversity staff member to HGCP with the primary goal to progress early, regular engagement necessary for a successful offset program. An engagement program is underway targeting the three pillars of local employees at HGCP, schools in the area, and communities specifically in the PDL1 and PDL7 areas where significant biodiversity values exist. Visits with the communities have allowed the Project to gain a basic understanding of community demography, land tenureship, linkages between the people and their environment, and the relationships between the various communities. Engagement with local HGCP employees has resulted in over 30 employees that will help form contacts and networks across communities within and around Hides Ridge. Challenges remain, including ongoing tribal fighting, but the Project is now starting to identify how to implement the process for establishing newly protected areas as part of the long-awaited Upper Elevation Zone offset program, as described in the BIMP. The IESC is therefore able to close the Non-Conformance M19.2 in the Issues Table, and progress through the necessary work activities will be followed closely in future IESC visits.

Alternative Livelihood Strategy for Offset areas

During 2021, EMPNG initiated a piece of work to help ensure the success of its on-the-ground offset program. A risk assessment was undertaken to better identify the challenges that might preclude success, for example, negative impacts on the community from the Project seeking to preserve biodiversity values in newly protected areas, and community backlash (or loss of support) resulting from restrictions on their traditional use of natural resources, whether real or perceived.

The primary conclusion from the assessment was the need to implement alternative livelihood programs in each offset area to promote more sustainable use of resources within those areas that may be formally protected. As implementation of each key offset activity is different for each offset area, so should the alternative livelihood plans applicable at each area – this mirrors the IESC recommendation in the last report to have offset management plans for each distinct offset area.

An Alternative Livelihood Strategy (ALS) will be developed during 2022 to guide the development of the program. The site-specific ALS plans will identify areas for support including increasing agricultural productivity, nutrition and diversifying household income sources, potentially fishing and gleaning, self-employment and micro-enterprises such as establishing savings groups, providing services, etc.

The IESC agrees that successful conservation should be cognizant of the needs of people in and around areas of high ecological and ecosystem value. Such an ALS program if suitably funded and managed through time should help achieve sustainable gains over the required timeframe and increase the chances of offset success.

5.2.2.3 Legally Protected Areas

The IESC refers Lenders to the last report for background on EMPNG's responsibilities in relation to PS6 (2006) Paragraph 11 relating to operating in a legally protected area, including those related to the promotion and enhancement of the conservation aims of the protected area. Also reference Section 5.2.2.2 above on Offset Component 4 (existing protected areas) for how the Project's support for conservation should address all priority biodiversity values within the protected area.

The Project has undertaken over a decade of solid foundational work with the WMA Committee as part of the mid-elevation offset program. The IESC Observation in the Issues Table recommends EMPNG now consider the gaps in alignment between the approach taken for offsetting residual impacts on specific biodiversity values versus the requirement to promote and enhance the conservation aims of the protected area within which the Project is located. The Project's exclusion of an updated scientifically robust aquatic biodiversity survey to support the preservation of the freshwater ecosystem, is not in alignment with primary conservation aims of the protected area. The IESC recommends the Project plan to include an updated appropriate assessment of the Lake Kutubu freshwater ecosystem via a PMA3-type biodiversity assessment survey as part of the foundation for enhancing the conservation aims of the WMA.

5.2.3 Recommendations

1. The IESC encourages the Project to seek engagement with conservation NGOs to help provide additional transparency and alternative viewpoints for the residual impact and offset programs;
2. When an observed clearance/forest cover loss event is deemed to be by the local community in close proximity to Project pipeline RoW and infrastructure, the Project should consider how the distinction is made as to whether the change is categorized as Project- or non-Project attributable, to acknowledge that both direct and indirect impacts might be Project attributable;
3. The Project intends that PMA-1 will indicate changes in habitat condition in areas that form part of the offset program, and the IESC encourages the Project to report on this during the next review;
4. The 2017 and 2019 PMA3 biodiversity reports should be posted on www.pnglng.com alongside the 2015 report. EMPNG might consider sharing PMA3 data directly with GBIF in alignment with the Equator Principles.

5.3 INDUCED ACCESS

5.3.1 Project Strategy

EMPNG's objective is to control vehicle access to Project roads and infrastructure, to prevent potentially damaging third party activities through enhanced access.

EMPNG has retained a number of RoW construction access tracks/roads for permanent use during the Production-phase, so as to allow emergency access, maintenance and delivery of fuel to above ground installations (AGIs), such as main line valves (MLV), check valves (CV) and cathodic protection stations (CP). Background on the justification for access and methods of access control is provided in the EMP and in previous IESC reports detailing our opinion on the status and effectiveness of each vehicle access control.

EMPNG's strategy is that access will generally be allowed only to EMPNG vehicles. The Project's management plans state access by third party vehicles serving operational needs may be sanctioned subject to prior approval from EMPNG, and that access by landowner vehicles may be sanctioned subject to approval from EMPNG. In both cases, access will be authorized only by designated EMPNG personnel. Vehicles will be inspected as deemed appropriate. A Vehicle Monitoring Plan (VMP) describes the process to be followed for vehicles seeking authorization to use EMPNG roads, and data is being gathered on type of vehicles passing through points where Access Monitors are located.

CEPA's Environmental Permit states that EMPNG is "required to establish and maintain systems to ensure project infrastructure and road systems are not used in any way to provide support of logging activity or any other uncontrolled access. Prevention of access should continue until such time as natural vegetation regrowth prevents their use."

5.3.2 Observations

There is little change to report in this section for 2021.

Ownership of Roads / Infrastructure and Responsibility for Mitigation

EMPNG advises there has been no change to previous updates regarding any requests from the Government related to handover of Project road-infrastructure such as the Southern Highway (Gobe to Kantobo road section) and the Kaiam Bridge (see IESC report November 2016, Section 3.2 and Section 5.4.2 p.42-43 for background) – the IESC retains at the end of this section the recommendation noted previously. EMPNG has completed an internal risk assessment developed in the eventuality of a request for handover of the Gobe-Kantobo section of the 'Southern Highway'. EMPNG intends to develop an MOU with the government to detail commitments for environmental and social protection.

The Project road linking the Kopi shore base to the Kopi Scraper Station at KP was formally handed over to the government in 2016 following their request in 2015.

Access Control - Upstream

EMPNG's strategy summarized above is generally to only allow access to EMPNG vehicles, and that access by third party vehicles is only by prior approval. In reality, the Access Monitors stationed at the Project's Kantobo to Gobe road allow free movement of vehicles along the 'Southern Highway' section although the Project confirms that vehicle and destination details are still recorded. A similar situation exists at the Project constructed Kaiam Bridge.

Of the 15 facilities/infrastructure areas being monitored, 12 are controlled as per the EMP requirements (EMP Version 3, available on www.pnglng.com). Three access areas are not controlled in the way stated in the EMP, due to uncontrolled situations:

- ✓ Angore Gathering System and Angore Spine – The gate is not locked but is manned by a Spotter because of ongoing Angore project activities;
- ✓ Condensate Pipeline (Check Valve) CV1 – The boom gate to restrict access to the RoW was removed by locals in 2019. Currently the boom-gate giving access into Angore Well Pad-B acts as the control to CV1 and the pipeline RoW. It is now manned because of ongoing Angore project activities;
- ✓ At Benaria Station, vehicular access to MLV1 is made possible through continued use of the track and bridge built during pipeline construction. The community also continues to use the bridge, as the government constructed bridge was washed away by a flood in 2017.

EMPNG advises that aerial patrols continue observing the entire RoW – their reports indicate no observed signs of logging adjacent to the RoW/infrastructure, and no bypassing of access control equipment, e.g. driving around locked gates.

As noted in the last two reports, this IESC report is based on desktop information only – we therefore propose that the next IESC site visit include a road-trip to visit key access controls around Angore, MLV1, MLV2 and from Moro to Kopi (as has been undertaken previously) to allow direct observation of access controls in place, including verifying presence and function of Access Monitors. This would also allow for on-the-ground observation of reinstatement/regeneration at points along the pipeline RoW where this intersects with the OSL/EMPNG/public road.

Access Control – data collection of Upstream vehicle movements

High level data for 2021 continues the trend of the Project's road being used primarily by Santos (formerly OSL) and their contractors, although since the start of the pandemic, numbers of private vehicles now dominate (36% in 2021). EMPNG notes the reduction in PNG LNG Project and OSL vehicles usage has been more recently driven by limited work activities due to COVID19.

Note: vehicle data breakdown/analysis from Benaria Station Access Monitor is no longer provided, last dataset seen was 3rd quarter 2015) and no data presented from the manned gate now at Angore track to Wellpad B.

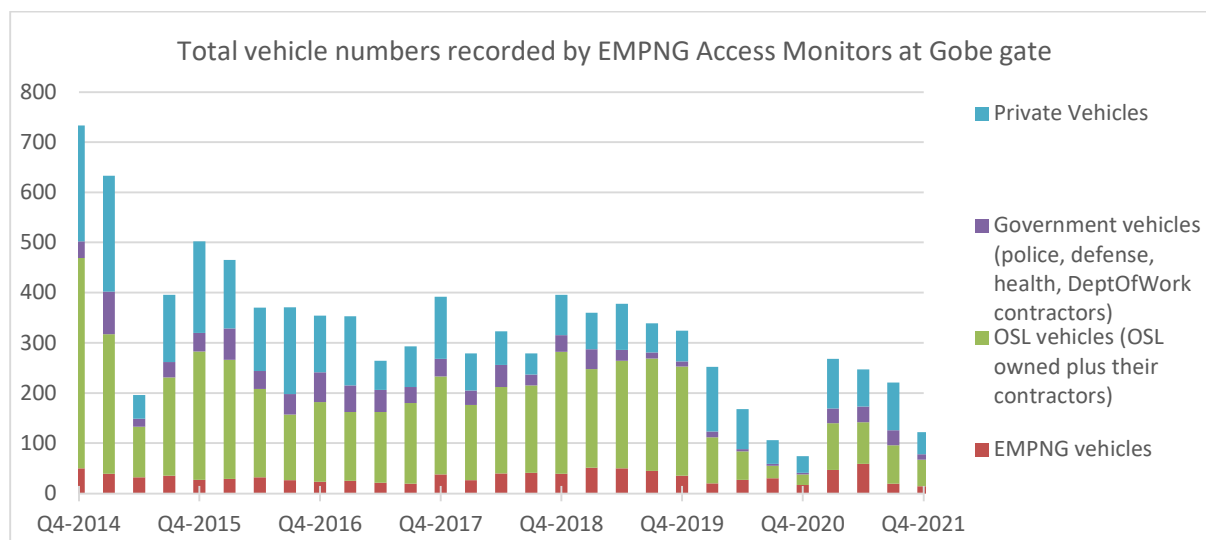


Figure 5.3: Vehicle Numbers using the Project's 'Southern Highway' Road between Gobe and Moro

Access Control – LNG Plant

IESC reports in 2018-2019 noted repeated vehicular incursions into the pipeline landfall RoW area, with evidence of mangrove trees being cut and extracted. During 2020/21, concrete blocks were placed blocking off the vehicular access route, and this has stopped people driving into the area. The Project reports there has been a reduction in local people accessing the area and there is now minimal mangrove harvesting.

EMPNG Community Affairs and Field Environmental Specialists continue with community liaison messaging, multi-lingual signs have been installed and surveillance is undertaken by Security using fence-line CCTV.

5.3.3 Recommendation

1. As previously, EMPNG should ensure as part of any negotiations with the PNG government regarding transfer of ownership of roads/infrastructure that every effort is made to prevent any ecological damage through third party access to areas, and therefore allow the company to uphold their commitments made to Lenders with regard to invasive species, induced access, and ecological management. Potential risks need to be fully understood and effective mitigation options discussed.

5.4 REINSTATEMENT AND REGENERATION

5.4.1 Project Strategy

EMPNG's objectives are to promote regeneration of temporary work areas disturbed during construction and achieve vegetation succession according to established benchmarks. Where new ground is disturbed, the objectives are to establish stable landform conditions and create ground conditions conducive to natural regeneration to then achieve vegetation succession as above.

The Regeneration Monitoring Program, currently undertaken every two years, uses fixed and random sampling and a benchmarking scoring system to evaluate the progression of plant community succession within the Upstream area. Project-affected areas undergoing natural restoration are visited, and progress compared against benchmark sites determined previously. The methodology is detailed in Appendix 3 of the Upstream EMP available at www.pnglng.com, and supplements EMPNG's regular aerial assessments of regenerating areas to check for evidence of encroachment or slope failure.

5.4.2 Observations

As this review is a desktop review, the IESC is not able to provide direct observations on reinstatement/revegetation progress.

5.4.2.1 Regeneration Monitoring

The 2021 regeneration monitoring mission was undertaken again by Binatang Research Centre (BRC) during Mar/April along the entire length of the RoW to determine how well natural restoration of the RoW is progressing over time.

The study report was produced in good time and has been shared with the IESC. The report concludes the RoW regeneration is still progressing along the expected trajectory for the restoration of the secondary, then primary, rainforest, although succession is occurring at varying rates depending on elevation and vegetation type. They conclude that succession in mid-elevation areas may have slowed due to persistently high grass cover, with the potential to block succession progress. At the higher elevation, slower rates are potentially due to the nature of unconsolidated material and soil disturbance caused during the construction phase. The impact from disturbances such as the 2018 earthquake landslips and the accidental vegetation clearance incident in 2019 by communities working on the Project's behalf, need to be monitored.

With regard to structural recovery, BRC notes convergence is taking place towards secondary forests (as defined by the benchmark data) for the ground and canopy cover, the cover of individual life forms, as well as the density, species diversity and biomass of juveniles and mature trees. A summary of progress and threats to rainforest recovery is included below for each benchmark vegetation group (BMVG) is presented below.

Note: BMVG types ordered by elevation from sea level (above sea level, asl) to highest altitude, are:

- ✓ 8A is swamp forest complexes around the Omati landfall, although not surveyed in 2019;
- ✓ 6A is low altitude forest on plains and fans (Mubi – Kaiam – Kopi);
- ✓ 7A is low altitude forest (medium/small crowned forest on uplands);
- ✓ 4A is upland sago swamp;
- ✓ 5A is forest types around Heartbreak Hill and steep slopes between Aiao and Moro, below 800m msl.
- ✓ 1C is *Nothofagus* dominated forest with *Nastus productus* (bamboo) understory;
- ✓ 2ABC is a combination of three different types of low to mid-altitude mixed forest;
- ✓ 3A is Pandanus swamp forest
- ✓ 1D is *Nothofagus grandis* dominated forest on ridges in Moro Ridge Camp area;
- ✓ 9A is lower montane forest above 1000m msl
- ✓ 1A is *Nothofagus pullei* at high altitudes, including Hides Ridge Special Area;
- ✓ 1B is *Nothofagus* dominated forest on Benaria plateau, although not surveyed during 2021.

BMVG	desired successional trajectory	overall succession progress	life forms cover convergence	high grass cover problem	alien P. aduncum threat	slowdown caused by disturbance	species composition convergence	Elevation m
6A	yes	good	yes	low	low	no	yes	54
7A	yes	good	yes	low	low	no	partial	250
4A	yes	poor	no	high	high	no	no	447
5A	yes	very good	yes	low	high	no	partial	601
1C	yes	fair	no	low	very high	no	no	833
2ABC	yes	very good	yes	low	medium	yes	no	927
3A	yes	fair	no	medium	medium	yes	no	960
1D	yes	fair	no	low	medium	yes	no	1161
9A	yes	fair	no	high	high	no	partial	1278
1A	yes	poor	no	high	low	no	no	2407

Figure 5.4: Summary of succession progress & current/future threats to rainforest recovery in individual BMVG's

Although not presented during the regeneration presentation, a critical problem BRC notes in their 2021 regeneration survey report, is that the RoW vegetation retains a higher cover of weeds than the secondary forest benchmark plots. BRC states that a number of broad vegetation groups harbor high densities of juvenile *Piper aduncum*, (Spiked Pepper, a Priority 1 weed), threatening to invade the tree canopy once they mature. They note this to be a particular problem at mid elevations (400-900 meters above sea level). By elevation they note:

- ✓ Mid-elevation mixed forest. There is a possibility for invasion of the tree community by the alien *P. aduncum* from the juvenile community where it represents 27% of all individuals;
- ✓ Low altitude *Nothophagus* forest with well-developing successional vegetation. Here the juvenile community is dominated by alien *P. aduncum* (56% of individuals), however overall juvenile density has been constant at the values already typical of early secondary benchmarks, grass cover remains high, and overall weed cover declined. Here BRC notes the possibility of the tree canopy being temporarily, for several years, overtaken by the alien *P. aduncum*;
- ✓ Mixed swamp mid-altitude forest. Affected by EQ. Weed cover has remained steady with increase of *P. aduncum* associated with earthquake-triggered landslides. It is likely that *P. aduncum* will continue its dominance on the landslides but not elsewhere in this area;
- ✓ Mid-elevation (1000 - 1300 m asl.) *Nothophagus/Syzigium* forest area. The 11% of the invasive *P. aduncum* juveniles is of lower concern considering that the species has not established itself in the canopy; increased future shading from the canopy is likely to lead to decline in *P. aduncum*.

They note that forest regeneration is now entering an important phase of canopy closure, as this typically means the vegetation composition remains fixed with whatever is the composition at the time of canopy closure. There are still new trees appearing rapidly, so they recommend the continuance of a 2-yearly regeneration monitoring regime. This would seem to be particularly important in relation to the potential for *Piper aduncum* to invade the canopy. BRC recommends a vector control team using chemical (herbicide) and/or manual (uprooting of juveniles) control of *P. aduncum* in the areas with highest abundance – Note: EMPNGs EMP already requires active control of all Priority 1 species along the RoW and at facilities and infrastructure..

Regarding the observed vegetation structure and composition of the RoW against benchmark plots, BRC notes that composition of vegetation on the RoW is showing no convergence to the benchmark plots species composition. BRC does not appear to be concerned by this and concludes the observed composition represents an equally direct pathway to forest regeneration, just not the one that was expected.

The next regeneration monitoring survey will occur in 1Q 2024. Detailed reviews of the regeneration monitoring report and the invasive species audit report were not possible within the timeframe of this review, and the IESC requests for future reviews that these reports are provided in advance so they can be read in good time.

5.4.3 Recommendation

1. EMPNG should identify what can be done in relation to the high densities of juvenile *Piper aduncum* that may invade the regenerating tree canopy once they mature.

5.5 INVASIVE SPECIES, PESTS AND PLANT PATHOGENS

5.5.1 Project Strategy

EMPNG's objectives are to prevent invasive species (i.e., priority weeds and pests) and plant pathogens from entering or becoming established in (or in the vicinity of) their facilities and infrastructure, and contain existing priority weeds, pests and plant pathogens already present. A Weed Identification Manual has been developed, the Weed Monitoring Protocol revised (as per the revised audit approach in 2018), and a Register of Invasive Species, Pests and Pathogens was previously kept to track any changes in invasive species type, abundance and distribution (previously updated through external specialist audits). Now, records are made by EMPNG's external contractor ISOS and staff members where weeds are noted and control measures performed.

The project footprint was originally split into separate Weed Management Zones (WMZs), each delineating broad ecological units based on previously understood patterns of distribution and abundance of weed populations; these zones were used for the phased mitigation approach as pipeline construction/reinstatement progressed through the Project area. The current approach (not reflected in the current EMP, 2018) was developed and applied in 2018 and assesses weed abundance and distribution across four elevation zones.

The EMP notes that invasive weeds exist in the natural environment but are categorized according to their potential for environmental harm and hence priority for management. The distinction between different priorities of weeds are defined as: Priority-1 (P1) weeds have the ability to suppress and displace most native species especially in new disturbed areas; ; the Project aims to control and monitor all P1 weeds and exclude them from all work areas through active control. Priority-2 (P2) weeds have the ability to become locally dominant with potential to outcompete some native species; P3 weeds have the potential to proliferate in new disturbed areas.

EMPNG commits to manage the threat of spread of *Phytophthora cinnamomi* by preventing the spread or introduction of Type A2 into unaffected areas, in particular ecologically sensitive areas susceptible to senescence.

With regard to quarantine implications of imports into PNG, EMPNG has developed and adopted quarantine requirements which aim to prevent the importation and spread of foreign invasive species, pests, pathogens or disease; quarantine requirements are contained within a Quarantine Procedure.

5.5.2 Observations

5.5.2.1 Weed inspection and control

Lenders will recall previous IESC reviews trying to gain an understanding of the distribution, abundance and spread of weeds, what ecological risks might arise from weeds observed in areas where they weren't seen previously, locations where weed control is particularly challenging, updates on priority areas for P1 high priority weeds control, etc. This information is still not being presented. This information is still not being presented to allow Lenders/IESC to understand whether concerns are being addressed. EMPNG has provided an updated weed Register again with no analysis of weed management challenges.

EMPNG states that weed control is ongoing at known sites, and that new sites are added in a timely fashion. They state resources are managed, training is given, adaptive management is occurring, along with strategic planning and site verification. The Weed Register has been provided which lists every control event that the contractor (ISOS) attends. In attempting to interrogate the Register to see what control has been undertaken on Homa Benaria (roughly KP60-30, including searching for both MLV2 and MLV-2) it appears only two visits were made in 2016, then two visits were made in 2021, just to MLV2 or KP50-53 where MLV2 is located⁴.

The IESC considers this increasingly difficult to review via remote desktop review. From the Register provided it is difficult to search on key priority areas and identify areas that are proving challenging for weed management. It is difficult to determine if some areas are more commonly infested that require more targeted repeat control. Site specific weed observations may be made by BRC during their monitoring surveys and emailed into HQ, and the Register lists every control event location and weed species targeted, but the system lacks the ability to be interrogated and for any analysis.

As reported a number of times in previous IESC reports, access to key priority areas by the weed inspection and control contractors has been hampered by logistical (e.g., availability of cars) and security challenges, the 2018 earthquake and COVID-19 travel restrictions. The IESC has previously perceived a lack of prioritization of resources available for widespread weed inspection, control and analysis, and has no evidence to indicate things have changed. The consequence of restricted weed inspection and control across the Upstream footprint means there are large expanses of the Project's footprint, including priority ecosystem areas, where regular systematic weed inspection and control has not occurred for several years (note the Homa Benaria area was finally visited in the 2021 weed monitoring survey, see below). The Level 1 Non-conformance in the Issues Table is retained as the IESC is required to flag the issue to Lenders. The current situation is not consistent with stated commitments in the EMP, and it is unclear whether the situation represents an immediate threat or impact to priority ecosystem areas.

5.5.2.2 Specialist Weed Audits

EMPNG's objectives are to prevent priority weeds from becoming established in the vicinity of their facilities and infrastructure; however, as is noted in the regeneration monitoring section above, unfortunately the P1 weed *Piper aduncum* has become established within the regenerating RoW, especially in the mid-elevation zone (400-900 meters above sea level). Although currently primarily juvenile plants are established, making up 27% of plant individuals present, BRC notes the possibility for it to invade the tree canopy when it matures.

The priority ecosystem of the Homa Benaria Ridge was finally surveyed by BRC in Nov 2021 following an extended absence of the team due to security concerns. Although the overall number of all weed species was lower in the Homa-Benaria transects than the average of all other Low Montane transects, the fact that it had a higher proportion of P1 weed species than other Low Montane areas does give concern. EMPNG is a little over-optimistic in emphasizing that *P. aduncum* was similarly abundant in Homa Benaria as it was in other Lower Montane areas surveyed, that weed communities found in the Homa Benaria region are not exceptional when compared to the

⁴ EMPNG indicated during finalisation of this report that in fact there have been only two visits overall: once in 2019 and once in 2021. This differs from our interrogation of the Register. The IESC is not able to determine whether the Register is wrong or the IESC's interrogation of it was mistaken, therefore both numbers of visits are represented until the Register can be discussed more fully during the next IESC review.

wider Lower Montane zone, and that P1 weed *Ludwigia leptocarpa* (the 3rd most abundant P1 species) was present but rare in Homa Benaria. The IESC suggests the short Homa Benaria Weed Report does not seem to acknowledge the priority ecosystem nature of the Homa Benaria area. During Pre-Construction, the area was noted as a mostly undisturbed habitat, having similar qualities to Hides Ridge, being largely weed free, primarily as a result of having no vehicular access. During construction, high-level quarantine and access control measures were deployed, including vehicle washdown mobile units where the construction access track left the public road in an attempt to keep P1 weeds out of the area. Early monitoring of the priority ecosystem was to ensure no new species of weeds were introduced, and no expansion of weeds.

High level results from the 2021 survey across the Upstream area were presented. A total of 389 transects, 500 m² each, were undertaken across all 4 elevation zones.

Piper aduncum was the most abundant P1 species overall and also in all four elevation zones. It was also the fastest increasing P1 species. Other common P1 species included *Desmodium sequax* (Lower Montane), *Ludwigia leptocarpa* (Foothills) and *Mikania micrantha* (Lowlands). No entirely new P1 species were observed during the 2021 survey. As a result of the survey, BRC now recommend active control of *Piper aduncum* (now across all zones), *Mikania micrantha* (in the Lowlands zone) and *Desmodium sequax* (in the Lower Montane zone) due to their current high abundance and the potential to impact natural forest regeneration. As noted above, *P. aduncum* is of particular concern as it is now the most abundant P1 species in all four elevation zones and increasing further.

The BRC report notes that frequent repeated disturbance exacerbates the spread and dominance of *P. aduncum*, and that avoiding repeated cutting/disturbance should be part of the control strategy. As *P. aduncum* is now widespread in parts of the RoW (especially mid-elevation, but also increasing particularly in the Lower Montane zone) this will be a challenge as regular cutting and maintenance of the RoW is required. They go on to say that *P. aduncum* species can mature earlier and start producing seeds faster than most of the competing native pioneer species that would be desired in regenerating RoW. But repeated vegetation cutting would thus remove sterile biomass of native species before they managed to produce seeds, while in case of *P. aduncum* some plants would be already fertile, producing seeds and increasing the *P. aduncum* seed bank in the soil – EMPNG's vegetation cutting/maintenance regime along the RoW should be cognizant of this and manage accordingly.

BRC recommends that (i) the present quantitative weed monitoring based on 350-400 transects per survey is continued on annual basis, required due to the rapid changes observed in the weed communities, (ii) weed surveys are conducted also outside the PNG LNG project at selected sites with various anthropic and natural disturbance regimes, in order to establish the benchmark values against which the ROW data could be evaluated; and (iii) the potential impact of *P. aduncum* on native vegetation is studied using experimental removal of this species from a series of plots established in the four elevation zones of the ROW area.

EMPNG proposes to move from annual weed monitoring to monitoring surveys every two years and has stated that the next specialist monitoring will be done during Mar/April 2023. Considering the IESC has repeatedly flagged weed management as an issue yet to be adequately managed/reported, and that BRC themselves recommend annual surveys continue, we strongly recommend that an annual specialist assessment continues.

5.5.2.3 Cane Toads

As reported in the last few IESC reports, cane toads (*Rhinella marina*) have become an increasingly challenging invasive species in the Upstream Highlands area. This toxic pest affects native fauna that die due to ingestion of their poison and can create imbalance across ecosystems wherever they are found. Following the detections of cane toads at Kopi Shore base during construction, at Tamadigi (around 2012/13), in Moro-B in 2015, at HWMF in 2016, and HGCP in 2018, a recorded increase in the number of sightings at HGCP and HWMF has prompted an increased Project response.

The Project's cane toad program strategy continues to be to limit the introduction of cane toads into priority ecosystems (Hides Ridge, Homa-Benaria Ridge and Lake Kutubu WMA). The program approach is three-fold:

- ✓ Prevention: talking posters and awareness raising brochures in English, Pidgin and Huli; ongoing vehicle/cargo and ground inspections; inspection quality and process verification;
- ✓ Detect: encouraging sightings/reporting/mitigation by project personnel; ongoing data collection and analysis;
- ✓ Respond & Recover: implementation of Cane Toad Management Procedure; targeted focus on vehicle/cargo and ground inspection where necessary.

Target areas for prevention, detection and response are the HGCP, the Hides vehicle-washdown facility, the Hides Waste Management Facility at Kopeanda, Moro, Komo and Angore. As noted in the PS6 incident section above,

although cane toads are still prevalent at HGCP and HWMF, data reported for 2021 indicate their numbers are much reduced due to the control measures introduced by the Project.

The Project has gathered valuable data, collating and categorizing findings for eggs/tadpoles and juveniles/adults (Figure 5.4). Observed number of juveniles/adults were initially quite staggering, although depending on location, numbers of juveniles and adults now appear to be decreasing in places such as the HGCP.

The Project confirms they continue to receive external specialist guidance and advice (as noted last year) and have adjusted management protocols to include additional target locations. As cane toads were in PNG prior to Project construction, it appears EMPNG is currently taking reasonable mitigation measures to try to address a very difficult challenge. Key from a Lender risk perspective is that the Project continues to receive specialist advice from external experts and acts responsively to their recommendations.

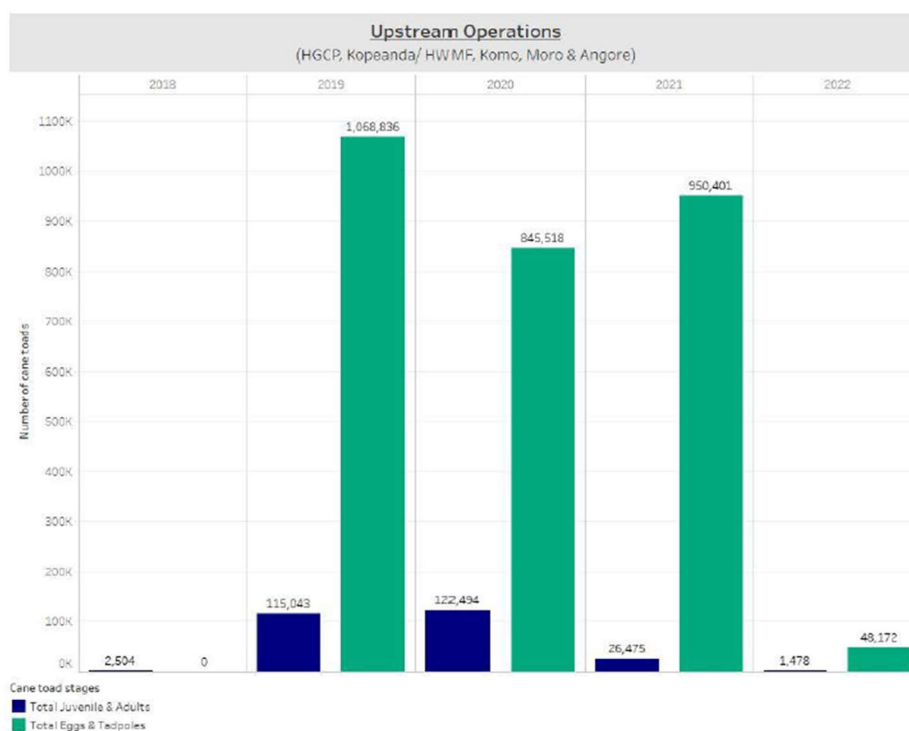


Figure 5.5: Cane Toad Observations

5.5.2.4 Dieback

As noted above in Section 5.2.2.1 the PMA3 field scientists had noted increasing stress and death in *Nothofagus* trees along the forest edge on Hides Ridge has been observed over the last few years. Although not yet proven, this could potentially be due to the plant pathogen, *Phytophthora cinnamomi*, to which *Nothofagus* trees are particularly susceptible; other contributing factors could include changes to drainage, light conditions and soil disturbance. The last IESC report recommended that EMPNG consult appropriate pathogen experts to determine whether specialist sampling is warranted at dieback sites on Hides Ridge for exotic Type A2– note Type A2 had only previously been recovered at sites below the HGCP, and measures such as the vehicle washdown were implemented to avoid Type A2 reaching and affecting the Hides Ridge, a priority ecosystem as per the Biodiversity Strategy.

No slides on this were presented during this review, but in response to IESC questions, EMPNG stated that the potential dieback on Hides Ridge noted during the 2019 PMA3 surveys had not yet triggered any sampling to confirm or determine the type of dieback present. EMPNG states that photographs taken of the potential dieback during 2021 surveys have been forwarded to the scientific team leaders for their visual assessment.

The IESC recommends more urgency in EMPNG's approach so that priority analysis is undertaken of any suspected dieback on the Ridge, and the type of dieback determined (A1 or A2), to confirm whether active control measures should be implemented – a new Observation is noted in the issues Table in Section 2. As noted in the Esso Highlands Ltd 2013 report, 'Understanding and Management of *Phytophthora*' manual, Type A2 is a relatively

recent introduction to PNG and the full potential impact of this mating type on native vegetation is not yet known. Therefore, consideration of a sampling program and reinforcement of necessary mitigation measures would be prudent. EMPNG's Plant Hygiene Management Plan is relevant⁵, as stringent measures should be in place where necessary to prevent the any suspected movement of Type A2 (an introduced species) into the priority ecosystem at Hides Ridge. This issue will be followed up during the next IESC review.

5.5.2.5 Wallabies at LNG Plant

Wallabies (*Macropus agilis*) have been observed within the fence at LNG Plant since construction. However EMPNG states that during 2021 a significant over-population has been observed, posing a safety/health/security concern. The boundary fence and abundance of maintained grass within the fence has created a relatively safe habitat and breeding space. However, as a result of the higher population, local hunters are hunting through the fence from the public road, gun shots have been heard and intruders caught on CCTV at night trying to hunt wallabies inside the facility fence.

In 2021, the Project made several attempts to herd the wallabies to a feeding station where they could then be ushered out through a gate, but this effort proved to be unsuccessful. Messaging with the communities to stop hunting was also unsuccessful. Expert opinion was sought from the Port Moresby Nature Park macropod specialist and several options were considered to minimize and/or remove the population. However, their recommendation was to cull a portion of the population via shooting, as is common practice in Australia. CEPA was approached for guidance and to seek approval as this required a waiver to conditions within the Environment Permit. After consideration, CEPA approved the request for a partial cull of up to 1000 animals by a professional shooter and noted a number of specific conditions to be followed. EMPNG undertook a hazard analysis to prepare recommended mitigation actions and responsibilities related to a number of What-If scenarios. The cull occurred during Feb 2022. Copies of the specialist's recommendations and the CEPA approval letter have been provided to the IESC as evidence of the intended approach.

5.5.2.6 Quarantine

The National Agriculture and Quarantine Inspection Authority (NAQIA) is the public-funded institution under the Ministry of Agriculture and Livestock whose role is the protection of Papua New Guinea from infectious pests and diseases that have the potential to seriously harm PNG's unique animal and plant life and affect economic growth. Prior to construction, a Lender concern was to ensure the project did not create undue pressure NAQIA resources, hence the IESC has tracked EMPNG-related imports over time.

Over the course of 2021, the number and volume of import shipments continued to fall from the high import volumes that were observed during the construction period. EMPNG's data (Figure 5.5) indicate the numbers of shipments, plus the number of required NAQIA inspection and refumigations. Over time, NAQIA's refumigation requests have decreased, with no fumigations required during 2021.

The processes developed by the Project to better understand the reasons for inspections, and look to resolve re-fumigation issues at source, have paid dividends. Any re-fumigation is now investigated and discussed with NAQIA, who now in turn are prepared to discuss details with the Project, which have resulted in an overall improved quarantine management process.

⁵ During finalisation of this report, EMPNG stated the Plant Hygiene Management Plan is no longer current as it was developed for the Construction phase.



Figure 5.6: Summary of Project-Related Shipments, NAQIA-Required Inspections and Re-Fumigations

5.5.3 Recommendations

1. The IAS Environmental Protocol should be updated to reflect the changing distribution of cane toads. The Protocol is dated 2015 and at that time notes they had not been seen in the Hides and Moro-Lake Kutubu areas;
2. EMPNG proposes to move from annual weed monitoring to monitoring surveys every two years. Considering the IESC has repeatedly flagged weed management as an issue yet to be adequately managed/reported, and that BRC themselves recommend annual surveys continue, we strongly recommend that an annual specialist assessment continues;
3. Recommend that active weed control of all P1 weeds found at Homa Benaria is undertaken as a priority;
4. EMPNG's RoW vegetation clearance and maintenance regime should be cognizant of the presence of *P.aduncum* and avoid cutting the weed when fertile to avoid the spread of seeds (in line with information in BRC regeneration report and Section 5.5.2.2 above).

6 SOCIAL

Caveat: As a consequence of COVID19, the IESC has been unable to visit the Project since 2019. This 2021 review, thus, was undertaken through a desktop study. The observations and opinions reported herein are based solely on presentations provided by EMPNG and some additional documentation.

6.1 LAND ACCESS, RESETTLEMENT, AND LIVELIHOOD RESTORATION

6.1.1 Project Strategy

The Land Access, Resettlement and Livelihood Restoration Management Plan – Production applies to any new land access required during the Production phase and for managing the commitments for land that was obtained in the construction phase. This Plan supersedes the Resettlement Policy Framework developed for construction phase land acquisition. Livelihood restoration obligations for displacement that occurred during the construction phase, as well as evaluation of resettlement and livelihood restoration outcomes and the independent external audit of the resettlement and livelihood program, are also covered by this Plan and will be concluded in the Production phase.

The Plan defines the principles and approach to be used for management of the inter-linked activities related to accessing land, resettlement, and livelihood restoration. The content of the Plan is consistent with IFC Performance Standard (PS) 5.

6.1.2 Observations

6.1.2.1 Outstanding Resettlement Obligations – 2020 IESC Review

The two cases of resettlement in 2020 related to Pipeline repairs have been closed with no outstanding obligations for the Project. An outcome evaluation conducted post-resettlement indicates that all 10 affected households now have improved Standard of Living and Livelihood.

6.1.2.2 Current Resettlement

Resettlement activities initiated in 2021 are associated with works for Angore Wellpad C, pipeline remediation due to the 2018 earthquake, demarcating permanent exclusion zones or widening of the pipeline ROW. Demarcation of permanent exclusion zones is necessary to address potential landslips from 'land fills' placed during Foundation construction or to extend or widen the pipeline in certain areas to maintain pipeline integrity.



Figure 6.1: Angore Wellpad C Post-Displacement Structures and Gardens

The process used to plan and implement resettlement remains consistent with PS5 requirements with addendums to the original RAP prepared for each resettlement. These addendums are reviewed by the IESC in preparation for initiating a resettlement.

Losses incurred by the affected households include gardens, some of which are fallow, and most households have gardens elsewhere. The 3 households that lose a dwelling for which they will be compensated have access to dwellings elsewhere. A few bush or auxiliary structures will also be affected and compensated for.

Implementation status of affected areas along the Pipeline is given below:

- ✓ Completed with no outstanding obligations – 5 areas;
- ✓ Outcome evaluation to be completed - 1 area;
- ✓ Agreements to be completed for 4 areas (to be followed by outcome evaluation for 2 areas).

Outstanding actions are expected to be completed in March 2022.

6.1.3 Recommendations

None arising from this review.

6.2 COMMUNITY IMPACTS MANAGEMENT AND SECURITY

6.2.1 Project Strategy

Project commitments to community impacts management during Production are contained in the Community Health, Safety and Security Management Plan – Production that addresses health, safety and security from a community perspective. See Section 8.2 in this report for IESC comments on Community Health.

The objectives of this Plan are to:

- ✓ avoid or limit risks to and impacts on the health, safety and security of the community during the production phase from both routine and non-routine circumstances through implementing targeted prevention programs to reduce risks, along with the implementation of an effective monitoring and evaluation program;
- ✓ ensure that safeguarding of personnel and property is conducted in an appropriate manner that avoids or limits risks to the community's safety and security;
- ✓ maintain a monitoring and evaluation program that is community-based, participatory, and transparent and covers all phases of production and decommissioning; and
- ✓ Elements of the Production Community Development Support (CDS) Management Plan also apply as it relates to community development support activities undertaken to mitigate the impacts or potential risks generated by Company activities with the objective to avoid or reduce the risk of adverse social impacts on Papua.

6.2.2 Observations

Tribal conflicts in the Upstream areas continue to be relatively calm, particularly in Hela and the Southern Highlands provinces where EMPNG has its operations. There have been, however, localized conflicts that do not result in widespread unrest, but that contribute to generalized political and economic instability in Highlands provinces that have occasionally caused disruptions along critical supply routes for EMPNG.

Tribal fighting in February 2021 in Tari (Hela Province) over a historical land dispute between two brothers resulted in 23 deaths and more than 1,000 displaced persons. Community tensions in Angore escalated after one of the fight leaders was killed in Tari. The Project Security Level was consequently elevated and non-critical activities suspended until the situation stabilized.

As a result of PNG government and foreign aid intervention, tribal fights subsided for the rest of 2021. The Hela Provincial Government and PM Marape hosted a peace ceremony in Tari in August which focused on ceasing tribal fights, reinforcing peace and stability and encouraged warring tribes to hand over high-powered weapons to Government security forces. Programs focused on youths with the aim of reducing conflict over the longer term have also contributed to reduction in tribal fighting. EMPNG continues to cooperate and support the United Nations PNG Highlands Joint Programme focused on conflict resolution and peace building in Hela and Southern Highlands province.

Frequent disputes over landowner royalty and equity payments and grievances with government policies, as well as high employment expectations in project areas, led to sporadic threats, public disturbances and minor acts of vandalism directed towards PNG LNG causing minor damage to PNG LNG assets. The incidence of crime also is high in the Highlands region, particularly in Tari, Mount Hagen and Goroka, exacerbated by the adverse economic situation caused by COVID-19. For example, on three separate occasions Linapini clansmen participated in violent criminality that included kidnapping, sexual and aggravated assault, armed robberies and illegal roadblocks on the Highlands Highway between Kobalu and Tari and in August a Public Motor Vehicle was held-up by 15 armed offenders in the vicinity of Tug (Southern Highlands Province) with major injuries reported. This incident was opportunistic in nature and conducted by outsiders scavenging for money and items of value.

In an attempt to quell criminal activity and regain stability, the GoPNG in April announced a new program of support to the law-and-order sector for Hela Province. This included the deployment of an additional Mobile Police Squad, advertisement of 500 Police positions, establishment of a reserve police structure, setting up a forward operating base for Defense Force personnel out of Tari and a total of K13 million in funding which includes K5 million to assist Correctional Services to develop facilities in Hela Province. EMPNG continues to partner with the Australian government-stewarded Justice Services and Stability for Development (JSS4D) program to improve the law and justice sector in Hela

6.2.3 Recommendation

1. The IESC appreciates the detailed information on the community security situation and looks forward to updates in the future.

6.3 COMMUNITY DEVELOPMENT SUPPORT PROGRAM

6.3.1 Project Strategy

Project commitments related to community development support are described in the Community Development Support Management Plan – Production. This Plan covers all community development support activities undertaken by the Project. The objectives of the CDS program apply also to project functions undertaking other community support initiatives.

The objectives of EMPNG community development support activities are to:

- ✓ promote development of conditions that strengthen communities' ability to benefit from the Project's presence;
- ✓ avoid or reduce the risk of adverse social impacts on PNG communities;
- ✓ provide opportunities for sustainable development benefits in a culturally appropriate manner; and
- ✓ ensure that the development process fosters full respect for the dignity, human rights, aspirations, cultures and natural resource-based livelihoods of Indigenous Peoples, thus meeting both local regulatory and IFC Performance Standard 7: Indigenous Peoples (2006) requirements.

6.3.2 Observations

6.3.2.1 5 Year Framework/Action Plan (2022-2026)

Community Development Support (CDS) has started work on a 5 Year Framework/Action Plan for 2022-2026. The initial phase of the planning is focusing on Program design considering key program area objectives (including selection criteria for evaluating potential projects against program goals and objectives) for Upstream North, Pipeline ROW and LNGP Plant site areas. Main issues to be considered include area context, focus areas, risks, and Government alignment. Other elements of the 5-year planning are to develop implementation and management arrangements (Execution model) and a Monitoring and Evaluation (M&E) LogFrame/Results Framework.

Activities for the first half of 2022 are focused on:

- ✓ Completing data collection and analysis on CDS 2015-2020 programs – overview, spend, types of projects implemented, challenges faced, key lessons and observed/Impacts;
- ✓ Drafting a TOR for a consultant to help develop the design framework;
- ✓ Meetings with key internal Project stakeholders for input to framework;
- ✓ Completing analysis of and alignment on priorities across National, Provincial and community levels to identify key focus areas for the next 5 years.

Observations

The IESC understands that development of a refreshed CDS Strategy and Plan has been hampered by the numerous effects of COVID19. We note, however, that the process may need to be accelerated in order to avoid loss of support from and/or frustration of communities. We suggest that the Project start developing implementation and management arrangements and the (M&E) procedure during the Design stage. We also note that Cross Functionality (see 6.3.2.2) is included in CDS implementation arrangements. We would also like to know what the role of the Consultant in the design will be given that Project staff already have quite a lot of experience in CDS program design.

Over the years since the CDS program began, the IESC has noted concern about whether the four focal themes (livelihood, health, education, law and justice) represent the most appropriate themes for a private sector project. Experience suggests that private sector investment in community development is most successful when it focuses on the themes (areas) in which it has most knowledge and an advantage in investing, rather than investing in all the areas where there is need for improvement. The largest percentage of CDS money spent to date, in fact, has been given to livelihood enhancement (@57%) which is consistent with the Project's knowledge and advantage. In contrast, very little support has been expended to the Law and Justice category (@3%) which, while important to the Project, is not an area of knowledge and advantage. The IESC recommends that the issue of focus thematic areas be evaluated in the new Strategy considering that a project can devote funds to various other entity programs, but a primary CDS program is most successful when it concentrates areas where a project brings its experience and knowledge. Doing so also is useful in both promoting and defending a project's choice of community investments.

The IESC observes that the information provided on CDS activities often does not provide a clear picture of the Project's role in each activity. The IESC requests that the 5 Year Plan/Strategy include provision of the specific role(s) of the Project in descriptions of CDS activities, such as financial, involvement in planning and/or implementation, etc. This might best be presented in a table containing columns, for example, but not limited to, category, project type, location, beneficiaries, PNG LNG role, partners and roles, timeframe, and to be added when available, outcome evaluation results. Such a table or spreadsheet would be a good tool for both internal and external use.

6.3.2.2 Cross Functionality

The IESC 2020 report noted that significant progress had been made toward achieving a Project-wide comprehensive and coordinated community support program that guides the contributions of all Project components (CDS and other components) to promote consistency in selection criteria, implementation, results assessment and reporting. To that end, the Project created a Strategic Community Investment Coordination Committee (SCICC), Asset Teams (Upstream and plant site) and a National Content Coordination Committee (NCCC).

In 2021, these groups have been active resulting in growing consistency in selection of community-oriented programs. As an example, the Biodiversity Team are developing an Alternative Livelihood Strategy (ALS) with the goal of implementing Alternative Livelihoods Programs in each offset area that builds on the extensive community capacity and relationship-building achieved to date to ensure that community subsistence and livelihood needs are enhanced by the Offsets, rather than adversely affected. The long-term economic benefits to participants will encourage self-sufficiency, independence and sustainable small and medium enterprises which, in turn, will assist EMPNG meet its offset commitments.

6.3.2.3 Project's Overview - Observations on CDS Program 2015-2020

The following observations are based on CDS's preliminary assessment of data on program components from 2015-2020.

Upstream

Spend on the Community Livelihood Improvement Project (CLIP) has been US\$1m/year. In terms of thematic category spend, 57% was spent on livelihood initiatives, 21% on education initiatives, 20% on health and 3% on Law and Justice.

Main summary observations are:

- ✓ Health indicators for most CLIP (agricultural program) participants have improved, particularly for older participants;
- ✓ Most CLIP groups are slowly advancing from subsistence farming to formal group arrangements thereby increasing earnings. Fresh Produce sales to date enabled communities to generate over PGK500k income since November 2016. The Paja'ipa Women CLIP group, for example, is now registered with the Investment

Promotion Authority (IPA) and is currently supplying fresh produce to HAG (Hides Alliance Group) camp caterers;

- ✓ Stability in key hot spot areas has grown;
- ✓ Key leaders in Hides and Komo are becoming more engaged and involved in the CDS program and its operations;
- ✓ Rugby League sports increasingly becoming a medium for youth involvement and resulting community stabilization (e. g, Komo Rugby League Competition).

Community Issues and Business Risks that continue to be observed include:

- ✓ Law and order remained relatively stable in most communities, but there is always a risk of outbreaks;
- ✓ Communities still recovering from the earthquake mostly in terms of rebuilding properties and livelihoods;
- ✓ Scholarship support for tertiary education noted – led to PNG LNG Scholarship program in 2020;
- ✓ Risk to operations and facilities at Benaria/Awatangi and Homa Paua (KP64).- potential for vandalism to company Fiber Optics Cable and stop work/ protests over royalty equity payments to landowners by government.

LNG Plant Site

Main summary observations are:

- ✓ Plant Site execution and spend was low against annual allocation in 2015/2016;
- ✓ Started joint collaboration with Gas Resources Directors in 2018 and 2019 on project identification. This allowed maximizing of EMPNG funds and Mineral Resources Development Company (MRDC) Community Infrastructure funds to do more in communities;
- ✓ School Governance training at Plant Site with close working relations with National and Provincial government influenced 'School Boards of Management Training' being introduced as a targeted area in the National Education Plan;
- ✓ Boera Primary School came first in the Province in academic standards and continues to do so;
- ✓ A student graduated from Project's Community Health Workers scholarship program was recruited to manage the newly built Porebada Health Center;
- ✓ Many of the women who were participants in the Project supported sewing program have transitioned to small sewing businesses.

Community Issues and Business Risks that continue to be observed include:

- ✓ Access to running water continues to be an issue especially during dry seasons;
- ✓ Fishers still trespass onto the Marine Exclusion Zone (MEZ).

6.3.3 Recommendations

1. The IESC suggests the Project start developing implementation and management arrangements and the (M&E) procedure during the Design stage and that Cross Functionality (see 6.3.2.2) be included in CDS implementation arrangements;
2. The IESC would appreciate information on the role of the Consultant in the CDS design;
3. The IESC recommends that the issue of the thematic focus areas (livelihood, health, education, law and justice) be re-evaluated in the new Strategy considering that the primary themes should be those in which the Project concentrates its attention;
4. The IESC requests that the 5 Year Plan/Strategy include provision of the specific role(s) of the Project in descriptions of CDS activities, such as financial, involvement in planning and/or implementation, etc. This might best be presented in a table containing columns, for example but not limited to, category, project type, location, beneficiaries, PNG LNG role, partners and roles, timeframe, and to be added when have, outcome evaluation results. Such a table or spreadsheet would be a good tool for both internal and external use.

6.4 NATIONAL CONTENT PROGRAM COMPONENT

6.4.1 Project Strategy

A key objective of the Project's National Content (NC) strategy is to replace expatriate staff with PNG citizens through both targeted recruitment and training and development. In addition, national content requirements set out in a National Content Exhibit are contained in agreements with key contractors. The exhibit states that contractors shall "develop and implement a Local and National Content Plan in accordance with the requirements in this Exhibit." The Exhibit requires maximization of employment of PNG citizens in all job categories and sourcing of all the PNG works will be in accordance with the requirements of this Exhibit and relevant law. The first priority is to be given to local persons (proximate to Company locations), while the second priority is to regional citizens, and third priority to persons elsewhere in PNG. It also specifies that the contractors should give preference to local LANCOs for provision of employees.

6.4.2 Observations

6.4.2.1 Key Highlights

National Content now reports directly to the Production Manager in an effort to elevate its visibility from being embedded in a support function to a direct line of sight to Senior Leadership. CDS remains with National Content. These two programs are broader than Land & Community Affairs (L&CA), thus being tied to the Production Manager enables better cross functional integration.

National Content Program

- ✓ EMPNG strategy has been refreshed and implementation plans for continuous improvement of National Content (NC) plans and programs are progressing;
- ✓ Supplier Development Committee and Strategic Coordination Committee will be established in 2022.
- ✓ NC collaborated with Total Energies on National Content for Papua LNG and is willing to share lessons;
- ✓ Annual National Content Award – recognized outstanding contractor for nationalizing its workforce.

Workforce Development

- ✓ Refreshed and communicated the talent strategy – implementation in progress;
- ✓ Initiatives to develop workforce (mentoring, supervisor networking, training, graduate and internship programs) are ongoing;

Supplier Development

- ✓ Revitalized the Enterprise Center's role into the Supplier Development of NC;
- ✓ National Content Exhibit for contracts endorsed and internal awareness being progressed;
- ✓ Increased collaboration between key external stakeholders in partnership with Business Council of PNG workshop.

Strategic Community Investment

- ✓ Improved stewardship of SCI and CDS Programs (increased integration with asset management teams).

6.4.2.2 Workforce Statistics

PNG Nationals now compose 89% of the Project's workforce – a slight decrease of 2% from 2020 attributed to the inclusion of smaller highly skilled 3rd Party Contractors (in reporting) and resumption of Angore & EQR ROW. The number of contractors included in reporting National Content increased from 16 to 25. The actual number of PNG staff is 2,978 at the end of 2021 compared to 2,539 at the end of 2020 indicating recovery from the decreased number of PNG staff at the end of 2020 due to COVID 19 impact. O&M Intake 6 technicians on boarded.

See Table 6.1 for details on workforce statistics.

Table 6.1: Workforce Statistics

Statistics on Workforce	Year End 2018	Year End 2019	Year End 2020	Year End 2021
Total Workforce across Project	3,295	3,964	2,784	3,339
PNG Workforce nationalization (%)	2,769 (86%)	3,411 (86%)	2,539 (91%)	2,978 (89%)
EMPNG* PNG Workforce (%) nationalization)	543 (69%)	520 (65%)	585 (81%)	604 (80%)
3rdParty Contractor PNG Workforce (%) nationalization)	2,226 (91%)	2,891 (91%)	1,954 (95%)	2,374 (92%)
PNG Citizens Female workers (% Female)	538 (19%)	569 (17%)	506 (20%)	579 (19%)
Origins of PNG Workforce				
Local Origin – P1 (%)	1,160 (42%)	1,690 (42%)	1,164 (46%)	1,333 (45%)
Regional Origin – P2 (%)	901 (33%)	936 (27%)	736 (29%)	751 (25%)
National Non-Project Areas – P3 (%)	708 (26%)	785 (23%)	639 (25%)	894 (30%)
PNG Workforce by Job Type				
Management (%)	250 (9%)	271(8%)	240 (9%)	167 (5%)
Office (%)	284 (10%)	307 (9%)	282 (11%)	529 (16%)
Field (%)	2,235 (81%)	2833 (83%)	2,017 (79%)	2,643 (79%)

*direct hire employees or employees from recruiting agencies

Of the 89% of PNG workers, 45% are from Project Impact Areas. In terms of gender, females make up 18% of PNG workforce. EMPNG O&M workforce is 34% female, among the highest in ExxonMobil worldwide, 65% of field site work force are female and females hold 11% (67 staff) of the management roles.

6.4.2.3 Workforce Development – Competency Enhancement

In terms of Competency Enhancement, 117,000 training hours were delivered in 2021- up from 86,000 hours in 2020. Emphasis is placed on leadership and supervisory skills development. Training continues to be enabled through the supervisor network, mentoring program and staffing and development processes

Training highlights include:

- ✓ 3rd year graduate management program on boarded 2 graduates (total 10);
- ✓ On-boarded 4 engineering graduates and 5 interns;
- ✓ 60 PNG employees in leadership roles;
- ✓ 8 Supervisor roles nationalized in 2021;
- ✓ 1 PNG employee on expatriate assignment;
- ✓ PNG Maintenance Planning & Scheduling Supervisor selected to support EM Global Projects in US.

6.4.2.4 Operations and Maintenance (O&M) Progress

Significant Nationalization progress has been made since start-up. Digitalization has promoted continuous improvement efforts for training. EMPNG continues to support Kumul Petroleum Academy (KPA) capacity building to enable international standard O&M training in-country. Training Intake 7 in 2021 sponsored 24 Operations Trainees (16 Operations, 8 Instrumentations) at KPA. The Junior Technician training program began in August 2021 and will be completed in July 2022. Successful trainees will join EMPNG in August 2022.

O&M Technician Progression – Competency Building

- ✓ 209 O&M Nationals at site;
- ✓ Achieved 100% PNG Citizen Operations Technicians in Control Rooms, Plants, Wellpads , Pipeline, and Maintenance technicians in Planning; Upstream Operations;
- ✓ 2nd female became an O&M supervisor;
- ✓ Pipeline (x2), HGCP Operations Shift 3 and HGCP Operations Shift 2 have national supervisors.
- ✓ LNGP Operations lead roles are 100% occupied by PNG citizens (2/8 F);
- ✓ Maintenance lead roles – 4 of 12 positions occupied by PNG citizens;
- ✓ CAS Craft/Field Assessors – 44 of 80 (55%) are PNG citizens of which 6 are female;
- ✓ O&M Technicians on Broadening Assignments - EMIT, OIMS, Contract Administration, Technical Writer and Process Safety;
- ✓ 2 Well Operations Technicians (from UOG LNG to UIS Wells).

2022 Focus

O&M Intake 7 trainees will be on-boarded. O&M Intake 8 recruitment will begin in Q2 for a planned 18 trainees (12 Operations, 6 Maintenance).

- ✓ Commence Junior Technician program at KPA in Q3;
- ✓ Partner with KPA for continuous improvement of course material; support training;
- ✓ Enhance roadmaps for Supervisor Path;
- ✓ Sustain and improve newly launched e-Learning safety inductions for all sites;
- ✓ Source in-country vendor training.

6.4.2.5 Local Procurement and Supplier Development – Highlights

Local Supplier Spend

- ✓ Production to date, EMPNG has spent over PGK 5b in-country with almost PGK 3.2b with Papua New Guinean businesses of which PGK1.6b spent with Lancos;
- ✓ During 2021, more than PGK490 million spent by EMPNG in-country, of this over PGK184 million with Lancos;
- ✓ 110 Papua New Guinean owned businesses including 10 Lancos engaged by EMPNG for production-related Activities;
- ✓ Project to date, EMPNG has invested over PGK27 million in PNG business development through the IBBM Enterprise Centre (EC);
- ✓ Facilitated first Extractive Industry Supplier Development workshop in partnership with BCPNG;
- ✓ National Content Exhibit for contracts endorsed;
- ✓ 2020 PNG LNG Local Business Development Annual Report presentation to DPE;
- ✓ Contractor NC Award Winner presented to Hides Security Services Ltd and Honorary award to FALCK.

6.4.3 **Recommendations**

None arising from this review.

6.5 STAKEHOLDER ENGAGEMENT AND COMMUNITY GRIEVANCE MANAGEMENT

6.5.1 Project Strategy

The Project commitments with respect to stakeholder engagement are contained in the Stakeholder Engagement Management Plan – Production. This Plan describes the processes and actions applicable during production. The overall objective for stakeholder engagement during Production remains to keep all stakeholders informed with respect to their specific interests, engage people in decisions that directly affect them, and maintain stakeholder confidence and trust in the Project and its activities through open, informative, inclusive and timely communications. A Village Liaison Officer Strategy for the Production Phase supports implementation of the Management Plan and the Land and Community Affairs Plan.

6.5.2 Observations

6.5.2.1 Engagement Overview, January - December 2021

The number of information engagements with large numbers of participants has declined over the last two years due partly to COVID19 and a shift of focus to smaller groups that address specific issues of importance to particular areas and groups. The IESC concludes that the shift in emphasis is appropriate given the stage of the project.

Table 6.2: Community Engagements in 2021

Location	Engagements 2021	Attendees 2019	Attendees 2020	Attendees 2021
Highlands	5,933	58,500	31, 667	30,155
Plant Site	1,490	7,623	4,814	7,450
POM Area	75	203	165	107
Totals	7,498	66,326	36,646	37,712

6.5.2.2 Issues and Grievances Overview January - December 2021

Issues

The number of issues recorded in 2021 is 1,199 – up from 513 issues in 2020. This increase is attributed to significantly increased work fronts as Covid19 impacts decline. Economic issues were the most frequent, related particularly to economic development, employment and Strategic Community Investment requests. Land Access and compensation represents the second most frequent category due to resettlement activities, Clan Agent Change and annual deprivation payments. A few issues related to community health and safety concerns

Grievances

A total 20 grievances were filed in 2021 most of which were environmental due to new construction (Figure 6.2). Of the 20 grievances, 14 were closed in 2021, 1 was closed in early 2022 and five of the more complicated grievances are under still being investigated to reach conclusion on mutually acceptable resolutions.

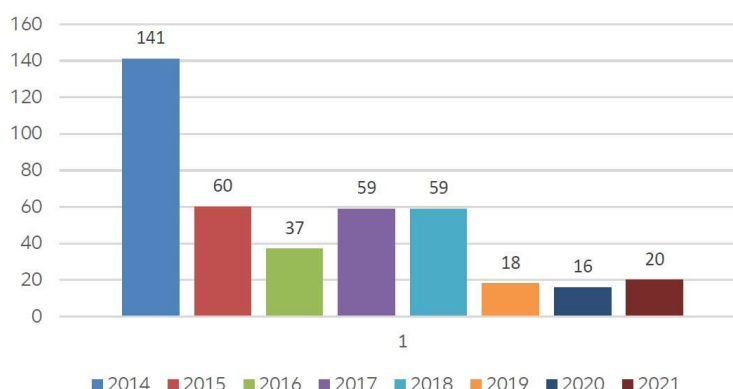


Figure 6.2: Grievances Registered

6.5.3 Recommendations

None arising from this review.

6.6 STATE CLAN BENEFITS INTERFACE - UPDATE

6.6.1 Project Strategy

The PNG Government is responsible and accountable for determination and payment of landowner beneficiary royalty and equity dividends. EMPNG's goal is to influence and support the Government in its effort to pay landowner State Cash benefits in accordance with the laws of PNG. Its main challenge in this objective is to help ensure safe, accurate, timely and effective delivery of cash benefits without having any actual control over the process. The IESC notes that the Projects' assiduous documentation of its support for the benefit sharing process is critical for risk management.

6.6.2 Observations on Status

The Project's strategy remains to mitigate near-term risk, support resolution of underlying issues, and capture lessons for potential future projects. To these ends, the Project continues to engage positively with the Co-Venturers, PNG Government and other key stakeholders. Continued progress is being made to deliver benefits to mandated beneficiaries.

The information given below is the Project's best understanding of the status of benefits distribution. Benefits distribution and related LOBID / ADR processes are managed and executed by the Government. EMPNG provides logistical support to related government activities as appropriate.

Status of benefit payments to Project Licensed Areas are as follows:

Downstream

- ✓ Total of K22.2M in royalties and equity paid since 2017;
- ✓ Next royalty payment indicated for 2Q 2022.

Upstream

- ✓ PDL 7: Inaugural royalty and equity payment of K19.6M to be made 1Q 2022;
- ✓ PDL 1: Four remaining legal challenges are still before the courts, but expected to be dismissed on the basis of similar challenges (total of 18) lodged around the same time in 2019 against the Ministerial Determination. The State-Solicitor has since given written clearance for LOBID activities to progress with clan account opening to commence as early as 2Q 2022;
- ✓ PDL 8: ADR reports completed for 4/5 blocks, with a Ministerial Determination expected to be made in 2Q 2022, excluding the Awatangi block, which remains under dispute and subject to further action by the State;

- ✓ PDL 9: LOBID completed for Juha Field with a Ministerial Determination made in March 2022 for clans from Western Province area. Validation work is currently being done by the DPE for clans from the Hela Province side, and will be subject to a separate Ministerial Determination;
- ✓ Pipeline Segments: Total of K21.2M in royalty and equity payments made to seven of the eight Segments since 2020. Segment 6 is awaiting g clearance from the Courts for its GR Director's election to proceed, as a prior requirement before beneficiary payments can be made.

6.6.3 Recommendations

None arising from this review.

7 LABOR AND HUMAN RESOURCES

7.1 PROJECT STRATEGY

Project labor commitments are defined in the Labor and Working Conditions Management Plan – Production (the “Plan”). The Plan describes the requirements and expectations in terms of compliance, reporting, roles, supervision and training with respect to labor and working conditions, including camp accommodation. It covers all production activities for Upstream Facilities, the Pipelines and the LNG Plant. This Plan is expected to be adopted and applicable to EMPNG contractors, recognizing that EMPNG’s effectiveness in managing third parties will vary in accordance with the leverage EMPNG is able to exercise. To the extent that EMPNG can exert influence over its supply chain, the principles in this Plan will also apply.

The objectives of the Plan are to:

- ✓ promote fair and equitable labor practices for the fair treatment, non-discrimination and equal opportunity of workers;
- ✓ establish, manage and promote a healthy management-worker relationship;
- ✓ protect workers’ rights including migrant and third-party workers; and
- ✓ promote healthy, safe, secure and comfortable accommodation that does not impact negatively on the communities in the surrounding area.

7.2 OBSERVATIONS

7.2.1 Professional Development

The Project uses various kinds of materials and activities, described below, to support workforce professional development.

- ✓ The *Supervisors Network* that provides virtual sessions focusing on equipping supervisors with information to cover key messages across the organization. During 2021, Right Work, Right Way, Performance Assessment and PNG Talent Strategy were rolled out;
- ✓ *Employee Development Forums* were continued with virtual sessions focusing on important guidance for employees to get the best out of their careers and as individuals. Particular attention was paid to productivity and effectiveness, how to write an effective PDS and effectively receiving feedback;
- ✓ A *Mentoring Program* that aims to enable employees to acquire the knowledge and skills that help them reach their ultimate potential and maximize their contributions to Company goals;
- ✓ The virtual *Toastmasters Program* that helps participants grow their communication skills;

The Project also organizes a workforce Giving Back program with activities in 2021 such as:

- ✓ Providing over 30 children of ExxonMobil PNG and contractor employees with back-to-school items after participating in a drawing competition;
- ✓ Staff volunteers planted mangrove seedlings on World Environment Day;
- ✓ EM Haus Christmas gifts given to St. John Ambulance.

7.2.2 Personal Development

The Project also supports staff personal development with various activities including:

- ✓ Business Acumen - Employee Finance Basics;
- ✓ International Women’s Day - Webinars and Male Advocates Group;
- ✓ Wanwoks - The Self Awareness Journey - Exploring what makes us, us;
- ✓ Senisim Pasin – Behind the Mask - Domestic Violence: An epidemic within the pandemic with Tribal foundation; and
- ✓ WEN Networking sessions: Monthly Networking sessions with leaders; Opportunities for women to discuss gender diversity, work-life balance and skill development with our leaders.

The Employee Health Assistance Program – the Face-to-Face counseling program that was suspended due to COVID19 resumed in Feb 2022. Employees can also take advantage of professional support available from Magellan Healthcare, 24 hours a day, 7 days a week, as well as participate in group counseling provided under EHAP Services (see Section 8.1.2.2 for more information on the health program).

7.2.3 Labor Grievance Management

The information received on compliance of policies, procedures, guidelines, and reporting formats covering labor and working conditions to the obligations of IFC PS2, international labor standards and PNG labor law adequately demonstrates compliance of the Project and its main contractors. The labor grievance management process remains part of the Project's Procedures & Open-Door Communication Policy.

According to the information provided the IESC, there were only two grievances, both for harassment, investigated during 2021. No time was lost to industrial action. As in 2020, the utilization of 'HR Direct' that allows employees to direct questions to appropriate teams through an automated system greatly minimized the number of issues that could escalate to grievances. From January to November 2021, 609 inquiries were received with an average response time of one day. Most inquiries were in regard to Savings Plan, HOAP and medical plans.

7.3 RECOMMENDATIONS

None arising from this review.

8 HEALTH AND SAFETY

The PNG LNG Project has a well-developed program to manage both occupational health and safety of workers, as well as a community health and safety program. The success of both programs has been based on the understanding that community and occupational health and safety are linked and interdependent on one another.

8.1 OCCUPATIONAL HEALTH AND SAFETY

8.1.1 Project Strategy

Occupational health and safety are managed independently of the Production ESMP within the ExxonMobil Operations Integrity Management System (OIMS), which is summarized within the ESMP such that the linkages between OIMS and environmental and social management are well defined. The ultimate goal of managing personnel safety is to achieve an incident-free workplace where “Nobody Gets Hurt”. Specific, measurable objectives that contribute to this goal are:

- ✓ reduce at-risk behavior (both on and off-the-job) and manage hazards associated with the work environment to significantly reduce Occupational Integrity risks; and
- ✓ hazard identification and correction programs are comprehensive and widely used across the Unit.

OIMS also provides the structure for identifying and managing health exposures with the following goals:

- ✓ protect the health of personnel on company premises and the public in proximity to our operations from adverse health effects that may result from our operations; and
- ✓ protect the personnel on company premises from environmental and health hazards prevailing in the environment.

The concept of protecting company personnel from health hazards prevailing in the environment is recognition that there needs to be a linkage between occupational and community health programs.

8.1.2 Observations

8.1.2.1 Worker Safety

The last Lost-Time Injury (LTI) was an attack on a worker from another worker in 2017 (not an accident) with more than 55 million work-hours worked since that incident and prior to that incident the Project had been LTI free for more than a year. This is a remarkable testament to a robust safety program. The Total Recordable Incident Rate (TRIR) is excellent although 2021 was not as good as 2020 with the TRIR increasing from 0.06 to 0.08 on the basis of 200,000 work-hours with both years as shown in Figure 8.1. This likely relates to the higher number of work fronts in 2021, but in any case, this is still an excellent TRIR number. There was a slight increase in O&I numbers, which probably reflect fewer COVID restrictions and an increased number of work-hours. Overall, worker safety exhibits a remarkable record.

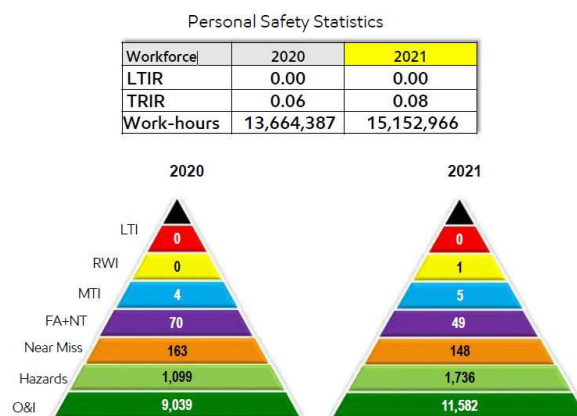


Figure 8.1: Safety Record 2020 - 2021

2022 safety key effort areas include:

- ✓ Transforming from managing data to leading learning culture;
- ✓ Continuing focus on enhancing process safety;
- ✓ Transitioning to the new OIMS Framework;
- ✓ Integrating human performance into daily processes;
- ✓ Refreshing Observation & Intervention; and
- ✓ Last-minute risk assessment programs.

These key effort areas have stemmed from the Safe Start 2021 program delivered with the engagement of management and kept visible throughout the year.

8.1.2.2 Worker Health

The occupational health program is world class and continues to perform well in all areas (clinical operations, public health and industrial hygiene). The dominant issue in 2021 was again the COVID-19 pandemic, which continues to be well-managed. EMPNG implemented an expanded COVID-19 testing program using PCR and Rapid Antigen testing kits while also partnered with PNG Department of Health and relevant Provincial Health Authorities to conduct vaccination drives whereby site coverage at the LNG Plant is 96% and 100% in the Upstream areas.

The Culture of Health (COH) program continues to be implemented with a COH Week undertaken in October 2021 focusing on biometric screenings, physical activity challenges, and mental health webinars. The attention paid to mental health is noteworthy because, due to COVID 19, face to face counselling was suspended. This personal counselling returned in February 2022, but in the interim employees were made available to professional support from Magellan Healthcare, 24 hours a day, 7 days a week, and group counselling was made available under the Employee Health Assistance Program (EHAP Services). The Industrial Hygiene Program continues to review worker exposure to chemicals and noise and verifies that personnel protective equipment is appropriate for the different work environments. A significant change to a long-standing program is with respect to requirements for protection against malaria in non-immune personnel. Malaria never proved to be the problem anticipated at the beginning of the Project and non-immune workers in Port Moresby and the LNG Plant are no longer required to take chemoprophylaxis while the - random testing has been discontinued for all sites (Port Moresby, LNGP and Upstream). Requirements in the Upstream area are being reviewed.

8.1.3 Recommendations

The H&S program continues to be implemented as a “best practice” system. The IESC does not offer any recommendations arising from the present review.

8.2 COMMUNITY HEALTH

8.2.1 Observations

Community health continues to be a component of the CDS program. In the Upstream area EMPNG continues to support the Hela Provincial Health Authority with food and other operational support, but especially with funding support to help manage COVID-19, as well as providing capacity training for health workers through Texas Children Hospital. 2021 support also resulted in EMPNG being invited to join as a member of the Hela Partnership Forum. This forum is attended by key partners (Oil Search, Australia Department for Foreign Affairs & Trade (DFAT) , United Nations and Church Health Services) to discuss and align on health support for Hela Province. This body coordinates all efforts and provides recommendations to Hela Health Board for decisions.

In the area of the LNG Plant EMPNG has also continued focus on COVID-19 responses with the leaders from the four local villages and Central Provincial Health Authority (CPHA). EMPNG participated in a COVID-19 vaccine awareness session at the Port Moresby Nature Park and with local radio to discuss EMPNG's support to staff, communities and the country during the pandemic. Another highlight in 2021 is that EMPNG started the construction and installation of the CPHA Pharmacy and Dispensary Unit at Konedobu. This will help improve timely disbursement of drugs to all district and community health facility at LNG Plant communities.

8.2.2 Recommendations

None arising from this review.

9 CULTURAL HERITAGE

9.1 PROJECT STRATEGY

Production has adopted Cultural Heritage Program from Construction:

- ✓ Cultural Heritage Management Protocol;
- ✓ Cultural Heritage Investigation and Salvage Protocol; and
- ✓ Chance Finds Protocol.

EMPNG's objectives are to avoid impacts to cultural heritage sites, including archaeological and oral tradition sites and to manage cultural heritage sites in consultation with landowners.

9.2 OBSERVATIONS

Cultural heritage management continues to be undertaken, currently in association with the Angore project, and preferred practice continues to be avoidance. In 2021 efforts in the field for the management of chance finds continue has continued with additional training of field personnel. Lithic artifacts identified from chance finds at Angore Wellpad C have been turned over to the PNG National Museum & Art Gallery.



Figure 9.1: Chance Find Stone Tool from Angore Wellpad C Construction Site

A focus of cultural heritage activities in 2021 has been to provide awareness on cultural heritage significance of the project footprint areas with project personnel and local stakeholders. Social Research Institute has been selected to document cultural heritage related legends and significant chance finds from the project footprint areas to teaching material targeting school children. A book is being prepared to document "Ethnographic and Archaeological Studies" on cultural values significant to the people and places along the ExxonMobil PNG LNG project footprint in Papua New Guinea.

ELESC/LUMEO/BARGR/EUGNA:eba04



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