PRELIMINARY ASSESSMENT OF IMPACTS ARISING FROM DRILLING ACTIVITY IN PSC TL-OT-17-09

TR-HSE-EIA-002

REVISION HISTORY

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MANAGEMENT APPROVAL

POSITION TITLE	NAME	SIGNATURE	DATE
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DISTRUBUTION LIST

AUTHORITY/COMPANY'S NAME	DATE	REVISION
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ABBREVIATIONS

AAQ	Ambient Air Quality
AASHTO	American Association of State Highway and Transportation Officials
AKO	Adjustable Kick Off
ANPM	Autoridade Nacional do Petróleo e Minerais
API	American Petroleum Institute
AQG	Air Quality Guidelines
ASTM	American Society for Testing and Materials
AWS	Automated Weather Station
BAS	Business Activity Survey
BHA	Bottom Hole |Assembly
BOE/d	Barrels of Oil Equivalent per day
BOP	Blowout Preventer
CBL	Cement Bond Log
CFC	ChlorofluoroCarbon
CMC	Carboxy-methylcellulose
CO	Carbon Monoxide
CR	Critically Endangered
CSR	Corporate Social Responsibility
dBA	A-weighted decibels
DEM	Digital Elevation Model
DHS	Demographic and Health Survey
DNAS	Direcção Nacional das Aguas e Saneamento
DNMG	Direcção Nacional de Meteorologia e Geofisica
DST	Drill Stem Test
DTM	Digital Terrain Model
EBC	Escola Basico Central
EBF	Escola Basico Filial
EBS	Environmental Baseline Survey
ECD	Equivalent Circulating Density
ED	Eastern Drilling
EDTL	Eletricidade de Timor-Leste
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMoP	Environmental Monitoring Plan
EMP	Environmental Management Plan
EMW	Equivalent Mud Weight
EN	Endangered
ENSO	El Nino Southern Oscillation
ERP	Emergency Response Plan

GDP	Gross Domestic Product
GDS	General Directorate of Statistics Timor-Leste
GERTil	Grupo de Estudos de Reconstrução de Timor-Leste
GHG	Greenhouse Gases
HC	Hydrocarbon
HDPE	High-Density Polyethylene
HIV/AIDS	Human Immunodeficiency Virus Infection and Acquired Immune Deficiency Syndrome
HSE-MS	Health Safety Environment Management System
IFC	International Finance Corporation
ILO	International Labour Organization
IMCI	Integrated Management Child Illnesses
IOD	Indian Ocean Dipole
IOGP	International Association of Oil & Gas Producers
IPCC	International Panel for Climate Change
IPIECA	International Petroleum Industry Environmental conservation Association
ISO	International Standard for Organization
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
KCl	Potassium Chloride
KPI	Key Performance Indicator
LCM	Lost Circulation Material
Leq	Equivalent Continuous Sound Level
Lmax	Maximum Continuous Sound Level
LNG	Liquid Natural Gas
LOC	Loss of Containment
LOT	Leak off Test
MAE	Municipio Administração Estatal
MAFF	Ministry of Agriculture, Forestry & Fisheries
MDG	Millennium Developments Goal
MJO	Maden-Julian Oscillation
MoF	Ministry of Finance
MSL	Mean Sea Level
MW	Mud Weight
MWD	Measured While Drilling
NADF	Non-Aqueous Drilling Fluid
NAPA	National Adaption Plan and Action
NOC-TL	Nacional Oil Company of Timor-Leste
NORMS	Naturally Occurring Radioactive Materials
NOx	Nitrogen Oxide
NPHC	National Population and Housing Census

NT	Near Threatened
NTU	Nephelometric Turbidity Unit
OCHA	Office for the Coordination of Humanitarian Affairs
OECD	Organization for Economic Cooperation and Development
OMS	Operating Managements System
OPS	Oficiais Policia Comunitaria
OSCP	Oil Spill Contingency Plan
P&A	Plug and Abandonment
PACCSAP	Pacific-Australia Climate Change Science and Adaptation Planning
PDCA	Plan-Do-Check-Act
PDM	Positive Displacement Motor
PHPA	Partially Hydrolysed polyacrylamide
PM	Particulate Matters
PPE	Personal Protective Equipment
PSC	Production Sharing Contract
PSL	Product Specification Level
RPM	Rotation Per Minute
rr	Restricted Range
SEIS	Simplified Environmental Impact Statement
SEPFOPE	Secretaria de Estado para a Política de Formação Profissional e Emprego
SISCA	Servisu Integradu Saúde Comunitária
SLM	Sound Level Meter
SMC	Safety Management Consultancy
SME	Small and Medium-sized Enterprises
SO_2	Sulphur Dioxide
SOx	Sulphur Oxide
SOP	Standard Operating Procedure
SRTM	Shuttle Radar Topography Mission
SSB	Suai Supply Base
TD	Total Depth
TDS	Total dissolve Solid
TOR	Terms of Reference
TR	Timor Resources
TSS	Total suspended Solid
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nation for Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework for Climate Change Convention
URTI	Upper Respiratory Tract Infection

USGS	The United States Geological Survey
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compound
VU	Vulnerable
WB	World Bank
WFP	World Food Program
WHO	World Health Organization
WHT	Withholding Tax
WMP	Waste Management Plan
WOC	Wait on Cement

NON-TECHNICAL SUMMARY - ENGLISH

Timor Resources proposes to drill an exploration well as follow up to the 2019 seismic acquisition program in one location located within the Post Administrative Hatu-Udo, Ainaro Municipality, the well location is named as follows:

- "Rusa-1 Well" – Suco Foho-Ai-Lico

The well will occupy a site of 1 hectare within an approximate 2.5 hectare levelled and stabilised area during the drilling operation, for a period of approximately 2 months. In the case of an unsuccessful well the site will be rehabilitated to its original condition or handed over to an agreed after-use. In the case of success, the well will be suspended pending further appraisal.

The drilling operations will be conducted on a 24-hour, 7 day a week basis. Driving and non-essential operations will be restricted to daylight hours as much as possible. Dust and Noise will be monitored and kept within the allowable limits as required by applicable laws and/or good industry practice.

Timor Resources will minimise the impact on the neighbouring communities and environment as much as is reasonably possible. Public consultations will be conducted in concert with the authorities and any concerns that are raised by the public will be considered and a mutually acceptable solution will be sought.

Timor Resources will employ crews from the local area as much as possible, providing that they have appropriate qualifications for the position and are medically fit for the work.

NON-TECHNICAL SUMMARY - TETUN

Timor Resources propoen atu fura posu exploratoriu hanesan kontinuasaun ba programa akuizisaun seismico 2019 nian iha fatin ida besik Posto Administrative Hatu-Udo, Municipio Ainaro, no ho naran hanesan tuir mai:

- "Rusa-1 Well" – Suco Foho-Ai-Lico

Kada posu ida sei presija fatin ho luan hektar ida (1) iha rai ho luan aproximanda hektares rua ho balun (2.5) iha area nebe tetuk no estabilizada durante hala'o perfurasaun, ba tempu mais ou menus fulan 2. Wainhira la hetan mina fatin refere sei rehabilita ka restaura fila fali ba ninia kondisaun original no entrega fali ba nain tuir akordu ne'ebé iha. Wainhira suksesu ka hetan mina, posu ne'e sei suspende temporariamente hodi halo evaluasaun klean liu tan.

Perfurasaun sei hala'o iha 24 oras nia laran, loron 7 iha semana ida nia laran. Movimentu kareta no servisu/operasaun la importante sira sei limita de'it durante tempu loron-matan nian wainhira posivel. Rai rahun no barullu sei monitoriza no sei lao tuir limitasaun ne'ebe autoriza ona hanesan hatur iha Lei aplicável no/ou pratica industria nebe diak.

Timor Resources sei minimiza impaktu ba komunidade ne'ebé hela besik no ambiente wainhira posivel tuir padraun industria nian. Konsulta Publika sei hala'o ho ko'ordenasaun hamutuk ho autoridade sira no kualker preokupasaun ruma ne'ebé levanta husi públiku sei konsidera no sei buka solusaun ida ne'ebé iha konkordansia mutual ka hamutuk.

Timor Resources sei uza pesoal sira husi area lokal ho numeru barak wainhira posivel, naran katak sira iha kualifikasaun ne'ebe apropriadu ba pozisaun ne'e no saude diak hodi servisu.

1 INTRODUCTION

Timor Resources, a company registered in Timor-Leste under TIN 20032094, and Timor Gap the National Oil Company of Timor-Leste entered into Production Sharing Contract PSC TL-OT-17-09 for petroleum operations on the 7th of April 2017. The Contract made under the Law No.13/2005 enables exploration activities to be carried out for the purpose of development and exploitation of Petroleum in the Contract Area. Timor Resources (TR) is the Project Proponent and Operator who on behalf of the Contractor group seeks to drill a single exploration drilling in good oil field practice. The Contract Area defined by PSC TL-OT-17-09 is an area that covers 1,291 km^2, including 1,002.4 km^2 onshore extending along the coastline for approximately 52 km and up to 30 km inland, and 288.6 km^2 of the near offshore for an average distance of 6 km from the coastline (Figure 1-1).

Based on Article 5 (defining project scope) chapter III environmental assessment information phase under Decree Law No.5/2011 Environmental Licensing and ANPM decision on category for drilling project in PSC TL-OT-17-09 ANPM/HSE/S/20/096 dated 13th August 2020, the proposed project that falls in Category A, thus requires a formal environmental assessment. The structure of the assessment process follows that is set out in the Annex IV of the Ministerial Diploma No.46/2017 of the 2nd of August 2017 . Further, Law No.5/2011 requires that full details of the project are disclosed to the public and that the public are engaged in public consultations as required in Ministerial Diploma No.47/2017 of the 2nd of August 2017 related to *Public Consultation Procedures and Requirements During the Environmental Assessment process.*

Timor Resources proposes to drill an exploration well as follow up to the 2019 seismic acquisition program in one location located at or near Post Administrative Hatu-Udo, Ainaro Municipality, the well is named “Rusa-1” in Suco Foho-Ai-Lico. A second area of interest known as Kameli was considered during the TOR process, but this has since been downgraded and is not considered further in the scope of work contained in this submission.

The Rusa-1 well will occupy a site of 1 hectare within an approximate 2.5 hectare levelled and stabilised area during the drilling operation, for a period of approximately 2 months. In the case of an unsuccessful well the site will be rehabilitated to its original condition or handed over to an agreed after-use. In the case of success, the well will be suspended pending further appraisal.

The drilling operations will be conducted on a 24-hour, 7 day a week basis. Driving and non-essential operations will be restricted to daylight hours as much as possible. Dust and Noise will be monitored and kept within the allowable limits as required by applicable laws and/or good industry practice.

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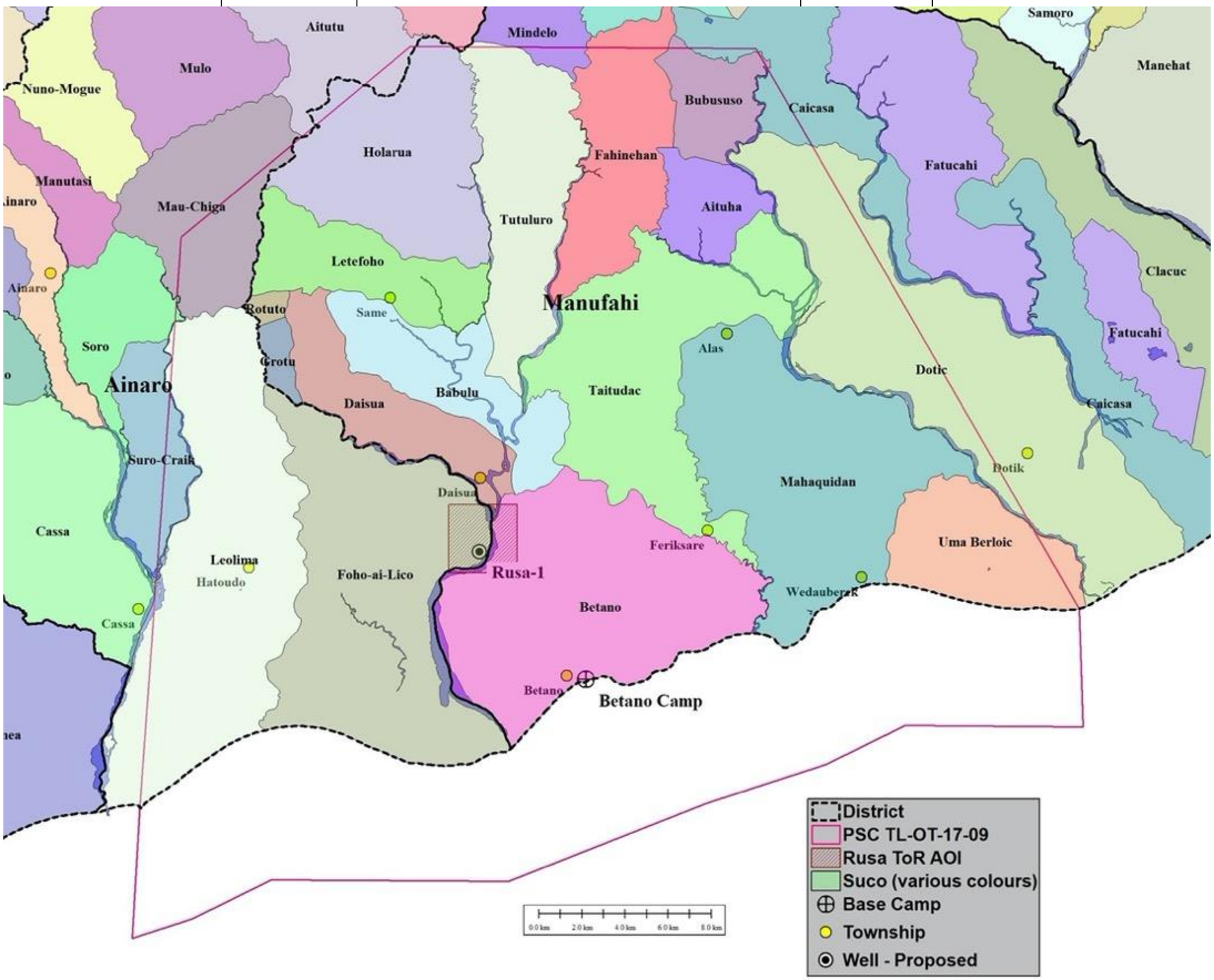

Figure 1-1. Map of Proposed Project Location and Well Area of PSC TL-OT-17-09

2 DETAILS OF THE PROJECT PROPONENT

2.1 DETAILS OF THE PROJECT PROPONENT

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The Company organisation structure is shown in Figure 2-1 .

2.2 COMPANY STRUCTURE

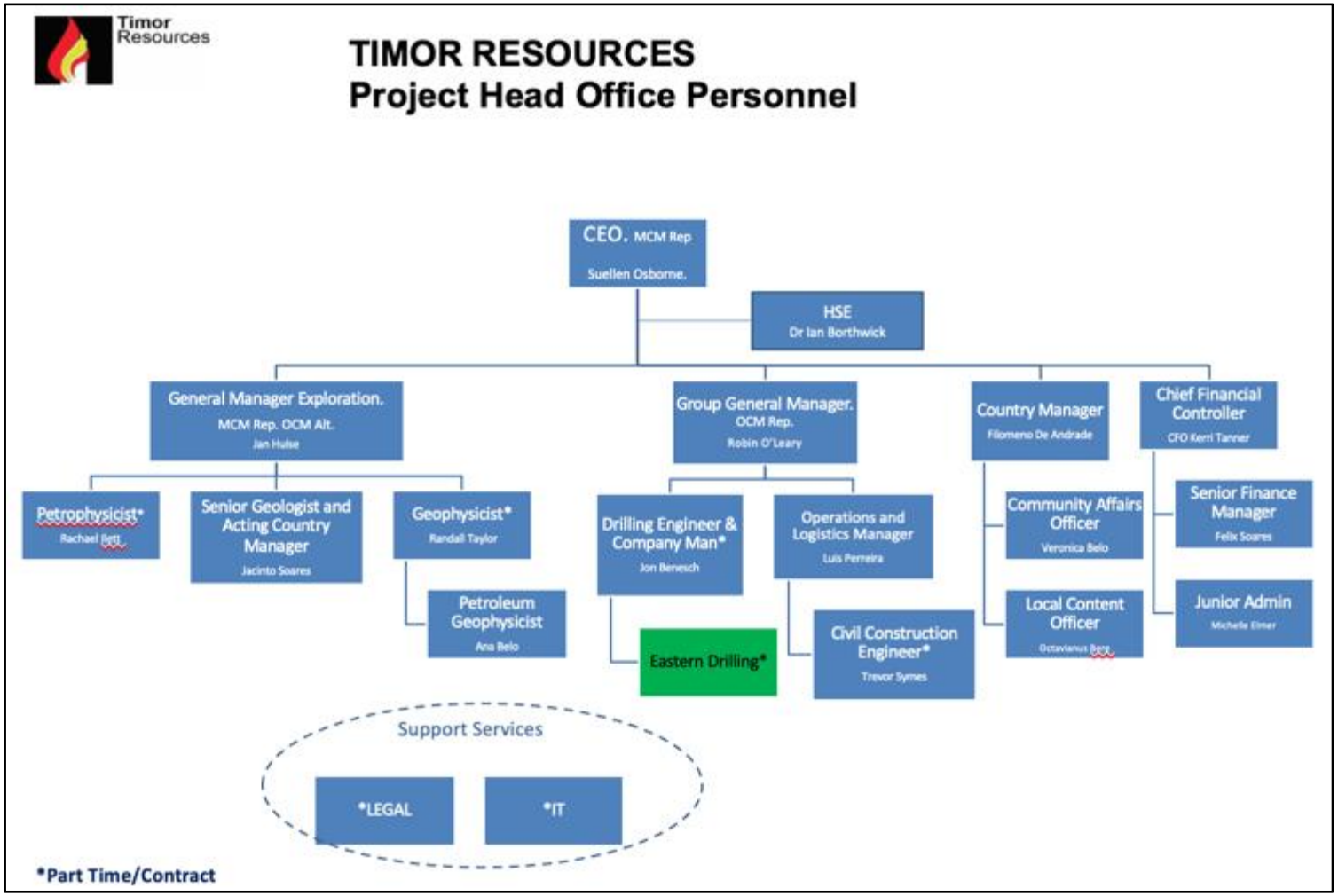


Figure 2-1. Timor Resources Organization Structure

3 DETAILS OF THE EIA CONSULTANT

Timor Resources has engaged with Groena Circoal, a Timor-Leste registered national consulting company to carry out the EIA study to produce the EIS and EMP for the proposed project. Groena Circoal has been providing services to several other domestic projects. Groena Circoal's have a number of key and highly qualified personnel. The following is the list of the proposed key personnel to be involved in this project:

Maria do Ceu Rosales
Maria is a graduate from the University of Western Australia majoring in Environmental Science and Business Law. She is an Environmental Scientist with more than 5 years' experience predominantly in the area of environmental assessment, management and public procurement.

She has led environmental studies on variety of environmental assessments and feasibility studies specifically for water resources management and has worked on a variety of projects from small-scale to large projects such as from established more than five water and sanitation projects to the rural communities and successfully completed marine environmental monitoring project for Tibar Port mega project. Maria has also involved extensively in drafting, review the laws and policy related to the procurement. She has more than 3 years of working experience in public procurement and preparation of contract and documents relating to Prequalification (PQ) of Bidders, Request for Quotation (RFQ) and Bidding Documents for the procurement of Goods and Works for ICB and NCB Contracts.

Emiliano de Oliveira
Emiliano is an Environmental Specialist with more than 8 years' experience in Environmental Impact Assessment (EIA), socio-economic and resettlement, Environmental Management Systems (ISO 14001), water-related issues, sanitation, occupational health & safety at work. He has been involved in various projects in both Timor-Leste and Indonesia, and is also a candidate for double Master's Degree in environmental science and Civil Engineering.

Pedro Pinto
Has 20 years' experience as an ornithologist and flora and fauna specialist. He has been working under Indonesian and Timor - Leste governments for Flora and Fauna Conservation. He holds a degree in Bachelor Science of Forestry.

Eufragio Xavier
Has over five years of experience in oil and gas sector, undertaking intense training and internship on HSE-related programs with ConocoPhillips Timor-Leste in Australia. He holds a degree in Petroleum Management.

Apart from the Timorese professionals, Groena Circoal also has access to highly capable international experts in various specialty areas to deliver a high-quality service within their consultancy group. In carrying out data collection and respective analysis for completing the EIA and EMP for this specific project, it is likely that Groena Circoal will only require local specialists: geologist, social scientist, flora and fauna and health and safety personal, including

local guides in executing the EIA process. Analysis of primary data will be carried out in local laboratories sub-contracting local consulting company.

Reflecting on the consultant's experiences and expertise in the area, Timor Resources deems that the consultant is suitable, qualified, and competent to carry out the EIA study for the proposed project. The details of the consultant carrying out the EIA study will be also be covered in the structure/content of the EIA and EMP in the next phase of the study according to the Ministerial Diploma No.46/2017 of 2nd August 2017, Annex IV and VI regarding the minimum requirements for EIA and EMP. Hence, any additional information required regarding this section can be covered in the EIA and EMP.

4 DESCRIPTION OF THE PROJECT

4.1 SUMMARY OF THE PROJECT

Timor Resources and Timor Gap the National Oil Company of Timor-Leste entered into Production Sharing Contract PSC TL-OT-17-09 for petroleum operations on the 7th April 2017. After initial technical studies and detailed field work activities the Fafulu 2019 2D seismic survey was justified and successfully acquired in 2019. Interpretation of this new seismic data through 2020 has identified a number of promising geological structures. One of these, named Rusa-1, has been high graded to prospect status and is drill-ready. In order to confirm the presence, volume and deliverability of hydrocarbons it is considered necessary to drill the Rusa-1exploratory borehole which is also a minimum exploration work requirement in the First Period (Contract Year 3) of the PSC.

In 2020 a drilling rig and support equipment were split into modules and were shipped into Suai and moved to the Karau-1 wellsite in PSC TL-OT-17-08. The drilling rig will firstly undertake exploratory drilling in PSC TL-OT-17-08 and this is anticipated to commence in early Q3 2021, subject to easing of restrictions imposed due to Covid-19 pandemic. When this first phase of drilling is complete the rig and equipment will be mobilized to PSC TL-OT-17-09 approximately Q3/Q4 2021 to undertake the drilling of the Rusa-1exploration well. The project is to be drilled in an aggregated campaign with exploration wells in PSC TL-OT-17-08 and will bring operational efficiencies and safety benefits stemming from a consistent body of work and experience gained in-country by the crew through the program.

Wells that are drilled to discover the existence hydrocarbons are termed “Exploration” wells. The location of a drill site depends on the characteristics of the Rig equipment, the well design, and surface conditions. The location selection criteria described in this report demonstrate a balance between environmental protection, logistical requirements, and the technical factors for successful drilling.

The Rusa-1well pad, located approximately 3.4 km South of Daisua, is estimated to occupy 2.5 ha and is to be constructed to accommodate the drilling rig and equipment and support services as well as an allocation of space for mud pits, a flare pit and earthworks and drainage areas. The entire location is cleared of all vegetation and topsoil prior to the start of any civil works. The vegetation and topsoil are stockpiled in a cleared area within the drilling location but outside the work area. A perimeter drainage ditch and berms are constructed around the location for containment and management of surface water. The wellsite incorporates two mud pits each with a combined volume of approximately 1908 m^3 (12,000 bbls), lined with a High-Density Polyethylene (HDPE) membrane liner. New access roads will be constructed on compacted sub-grade to form a road base 6 m wide, within a clearance corridor of 10 to 20 m.

The Betano base camp at Betano, previously used by Timor Resources for acquisition of the Fafulu 2019 2D seismic survey, is the central support camp for crew during the drilling of Rusa-1-1. The camp provides accommodation for the off-duty workforce, canteen facilities and provision for the collection, segregation and disposal of waste and recyclable materials.

The existing Haemanu camp in PSC TL-OT-17-08 (formerly a Covec road construction camp) will support drilling activities as a supply base as required (Suco Labarai).

Typical drilling rig modules include the derrick, sub-base, mud tanks and pumps, power generators, cementing equipment, mini-camp, and tanks for fuel and water (Figure 4-1). The mini-camp provides on-site accommodation for the senior drilling management, communications, vehicle maintenance and parking areas, fuel handling and storage areas, and provision for the collection, segregation and disposal of waste and recyclable materials.

Once drilling commences, drilling fluid or "mud" is continuously circulated down the drill pipe and back to the surface equipment. Its purpose is to balance underground hydrostatic pressure, cool and clean the bit and flush out rock cuttings.

The risk of an uncontrolled flow from the reservoir to the surface is greatly reduced by using blowout preventers - a series of hydraulically actuated steel rams that can close quickly around the drill string to seal off a well.

Steel casing is run into completed sections of the borehole and cemented into place. The casing provides structural support to maintain the integrity of the borehole and isolates underground formations that are often unconsolidated near the surface or where water aquifers may be present.

Drilling operations will be conducted on a 24-hour, 7 day a week basis. The time expected to drill the Rusa-1borehole depends on the complexity of drilling, the depth of the hydrocarbon bearing formation and the geological conditions encountered and is expected to be in the order of 30-60 days.

If the exploratory drilling and evaluation of Rusa-1supports the likelihood of potentially commercial quantities of hydrocarbons, the well will be Cased and Suspended and a wellhead valve assembly will be installed.

If the well does not contain commercial quantities of hydrocarbon, the site will be decommissioned to a safe and stable condition and restored to its original state or to a state as agreed with landowners and approved by the appropriate authorities. Open rock formations are sealed with cement plugs to prevent upward migration of wellbore fluids. The wellhead and the top joint of the conductor and casing strings are cut below the ground level and capped with a cement plug. After securing the hole the rig is dismantled and demobilized.

Timor Resources will minimise the impact on the neighbouring communities and environment as much as is reasonably possible. Dust and noise will be monitored and kept within the allowable limits as required by applicable laws and/or good industry practice. Public consultations will be conducted in concert with the authorities and any concerns that are raised by the public will be considered and a mutually acceptable solution will be sought.

Timor Resources will employ crews from the local area as much as possible, providing that they have appropriate qualifications for the position and are medically fit for work.

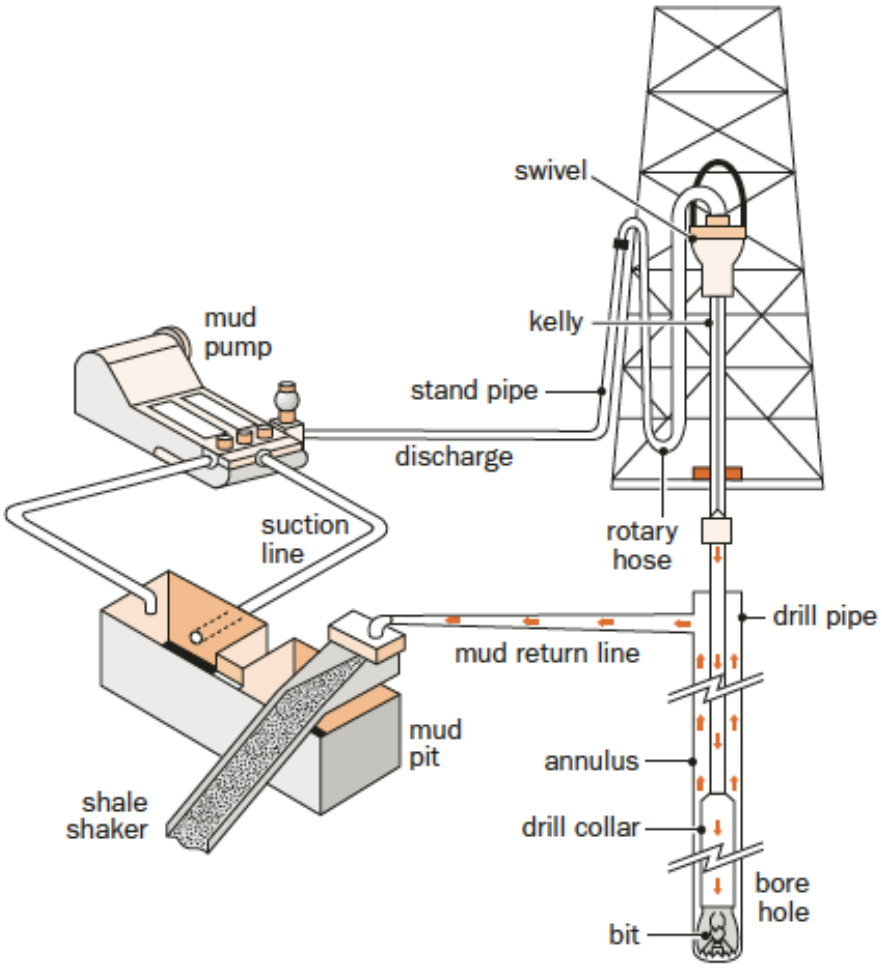


Figure 4-1. General Configuration of Onshore Drilling Rig

4.2 IDENTIFICATION OF THE PROJECT

This project is to conduct exploration drilling of 1 identified well location, namely Rusa-1. The well is located in the Ainaro Municipality, Hatu-Udo Sub-district of Suco Foho-Ai-Lico and Aldeia Raimerlau, with some additional transit and access to the neighbouring Manufahi Municipality. The exploration drilling is planned to commence during Q3/Q4 2021, subject to easing of restrictions imposed due to Covid-19 pandemic.

The well was identified as a result of prospect evaluation carried out in PSC TL-OT-17-09 by the Timor Resources exploration team during Permit Years 1-3 which ultimately defined the targeted plays to be drilled. The project is to be drilled in an aggregated campaign with exploration wells planned for PSC TL-OT-17-08.

4.3 PROJECT CATEGORY

The exploration drilling project was given the classification of Category 'A' by ANPM in accordance with Article 4, 1a and Annex I of the Decree Law No. 5/2011 of Environmental Licensing (13th August 2020) and this classification was based on the nature, size and technical characteristics of the project. Therefore, Timor Resources was required to submit a Terms of Reference (TOR) which was accepted on the 26th January 2021 (Timor Resources 2021a). The

Environmental Impact Statement (EIS) and an Environmental Management Plan (EMP) is required to seek Environmental Authority approval in order to gain an Environmental Licence to undertake the drilling activity.

4.4 BRIEF DESCRIPTION OF NATURE, SIZE AND LOCATION OF THE PROJECT

4.4.1 Nature of the Project

The exploration drilling activities will be conducted in three phases, Pre-drill, Drilling and Suspension or Abandonment.

The drilling program is designed to test multiple targets within 2 plays types within the area of PSC TL-OT-17-09, which are:

- Multiple targets in an interval of Jurassic to Triassic sediments in age and interpreted as either interbedded sands e.g. Plover or Foura member equivalents or age equivalent carbonates.
- A deeper Sub-Decollement target (possibly Triassic) which possibly represents underplated Australian continental clastic material. This deeper target remains **optional only** and is subject to a number of criteria including the presence of hydrocarbons in the shallower targets.

The drilling location is provided in Table 4-1 and Figure 4-2 . The proposed location is 3.4 km South of Daisua and is a 7.6 km North West inland from the nearest coastline town of Betano.

Table 4-1. Well Location, subject to final survey of actual borehole centre

Well	Rusa-1-1
Seismic Line	Fafulu23
Easting (UTM 51S)	795324
Northing (UTM 51S)	8991662
Latitude	-9.11205
Longitude	125.68675
Drill Floor (mGL)	5.33
Ground Level (mSS)	-96
Total Depth (mMD)	2601m (base case) 3936m (deeper option only)

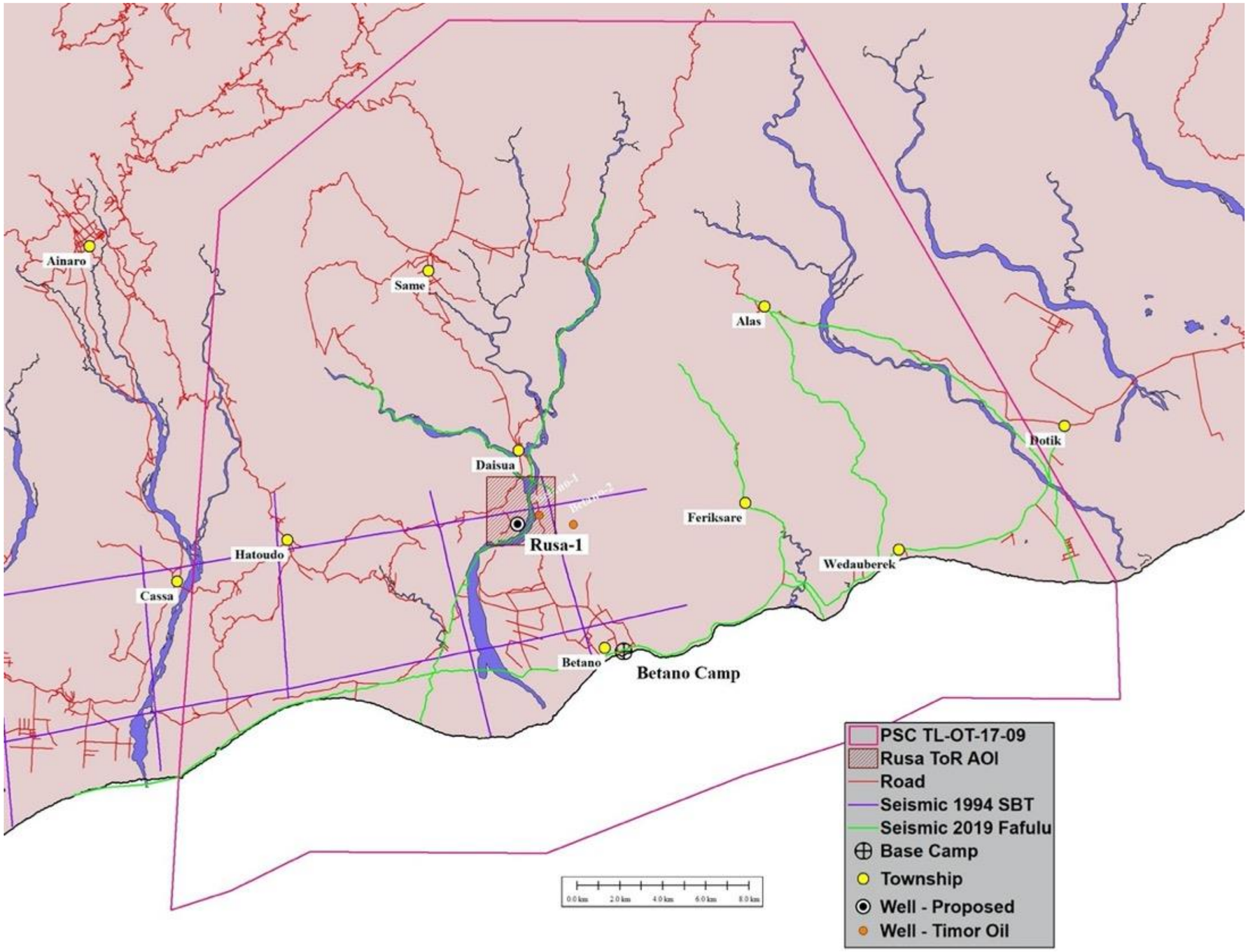


Figure 4-2. Location of Proposed Well, Betano Base Camp and Infrastructure

4.4.1.1 Pre-Drilling Operations

Pre-drilling operations include:

(1) Geotechnical, Geochemical and Topographic surveys

These surveys are conducted to gain understanding of the topography and soil characteristics of the wellsite and road access to undertake site design planning and subsequent civil works.

A geotechnical survey provides information on physical properties of soil which include structure, load bearing strength, and consistency. The geotechnical data is combined with geochemical survey results to determine environmental effects on soils, such as dispersion or expansion of clays. This data is used in planning of civil works, particularly for calculation of foundation requirements for the drilling rig and associated equipment and heavy vehicle usage on access roads.

A local topographic survey is carried out in the area of the proposed wellsite to plan the earthworks requirements for the site and access. The survey is used to calculate levels and the amount of cut and fill required. Natural and man-made features are also identified by the topographic survey for the environmental plan.

The local topographic survey is combined with a semi-regional Digital Terrain Model to delineate natural drainage patterns by watershed/catchment analysis. This analysis allows for planning of diversion of surface water within and around the wellsite.

(2) Land clearance for road access and site construction

The arable topsoil and vegetation are stockpiled on the side of the well site within the fence line or, in the case of access corridors, to the side of the road. The topsoil will be used to rehabilitate the site once drilling is completed in areas which are no longer required. Access roads will be 6 m wide with a 10 m wide road corridor clearance to allow for earthwork cut/fill slopes and drainage ditches when required. The corridor access clearance may increase locally to 20 m around tight corners or junctions.

River rock will be used as base course for the access roads. The required thickness of the river rock road pavement will be dependent on the sub-soil strength but is estimated to be in the 30 cm to 50 cm range. The wellsite area of approximately 2.5 ha will be levelled after topsoil is removed and river rocks will be used as base course up to 50 cm in thickness. If the geotechnical survey dictates, additional foundation will be used under high load bearing areas.

The wellsite design for the Rusa-1shown in Figure 4-3 .

(3) Road and bridge surveys plan, including highway and arterial and local roads.

TR and ED have carried out extensive surveys on existing roads, bridges, and highways (Symes 2020) in PSC TL-OT-17-08 and this information will be relevant to the first

section of the mobilization to PSC TL-OT-17-09. The new Tasi Mane highway has been designed and constructed using the American Association of State Highway and Transportation Officials (AASHTO) design code. Bridges and roads have been identified and mapped for the rig moves. All options have been reviewed for transportation; loads will be managed within the appropriate allowable road and bridge load capacity. Some tight corners by road from PSC TL-OT-17-08 to PSC TL-OT-17-09 may need to be modified to allow the rig trailer to pass.

(4) Establish water supply.

Daily water needs for drilling are estimated to be up to 60,000 litres per day. There is a flowing river close to the wellsite, this will be the first option for the water supply. In the event that the flowing river becomes dry the second option is to source water from local contractors with delivery to the wellsite by tank truck. Water storage tanks on site will be filled and a mud system mixed prior to spud of the well. The level of offtake from the water source will be such that it is not detrimental to the supply for other users.

(5) Wellsite

The typical wellsite consists of:

- Rig sub-base, carrier and derrick.
- Mini camp and office: set of mobile units used for accommodation, mess, storeroom and support offices for engineers and meeting spaces.
- Septic field: a portable fibre glass for black water will be used for a biotreatment method of water filtration before it is channelled underground to a leach field.
- Mud pits for drilling fluid
- Mud pump station
- Flare pit for well test
- Cellar around hole centre
- Parking space
- Laydown area for casing and drill pipe
- Power generator
- Perimeter fence surrounding the wellsite.

The layout dimensions are specific for each type and model of rig but can be adjusted, within limits, to sites that are not of uniform shape. Whilst the base layout design fosuch as deep draining gullies and positioning the wellsite in the optimal location with the overall lowest elevation gradient in the vicinity of Rusa-1 as shown in Figure 4-3 .

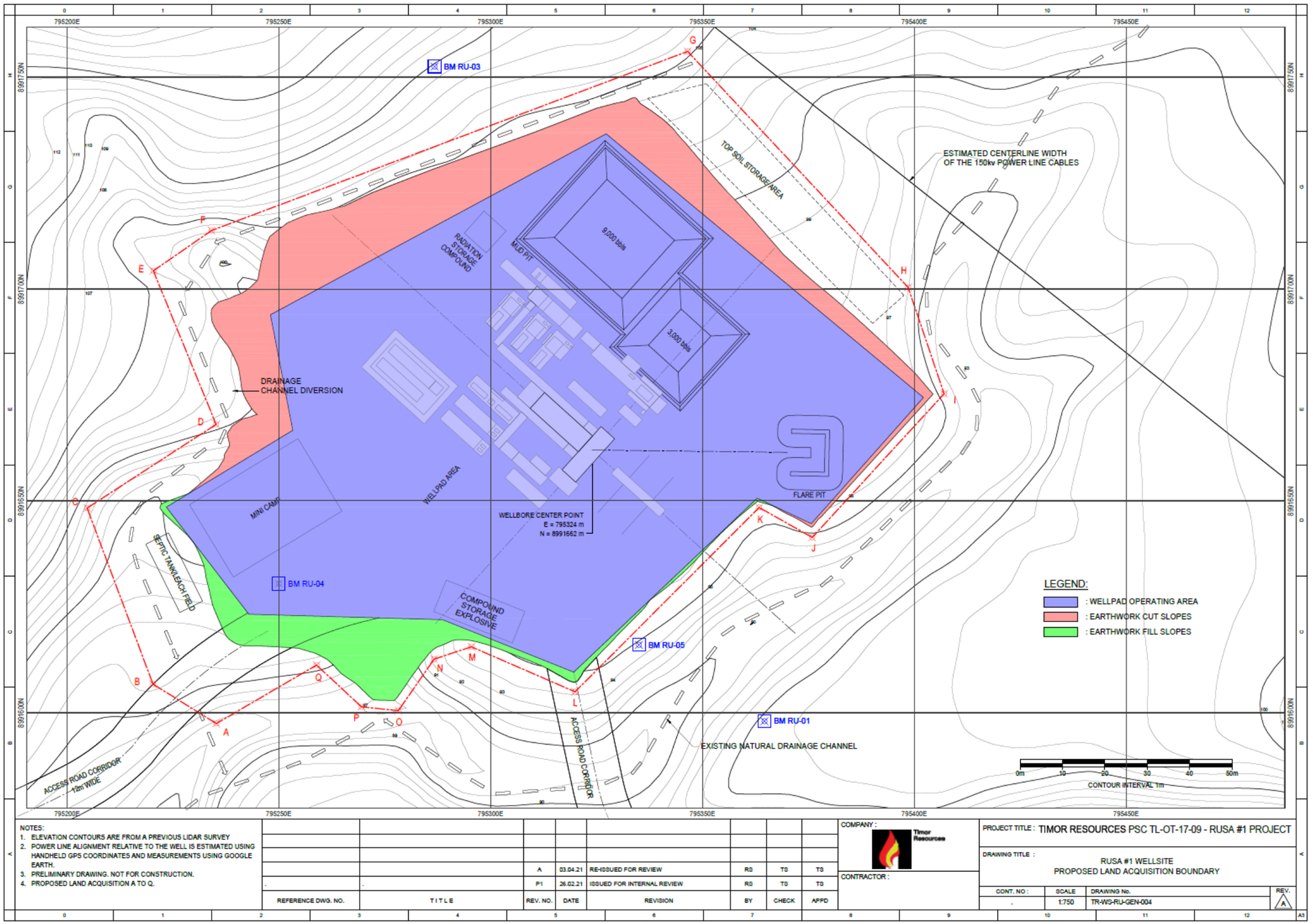


Figure 4-3. Rusa-1well layout. Subject to further surveying, civil engineering and design.

(6) Cellar construction with recess for air pump.

The objective of the cellar construction is to place BOP during the drilling operation. Ground preparation for cellar area will require 2.7 m in depth. A plate steel and concrete cellar with dimension of 2.9 x 2.9 m will then be installed.

(7) Mud Pits (sump) construction

Two 3 to 3.5 m deep mud pits with approximate dimensions of 20 x 22 m and 30 x 32 m will be prepared for mud handling and circulation. Final plan dimensions and depth will be provided in the detailed design according to the geotechnical conditions. An impermeable geomembrane will be used in the pit as barriers to prevent soil contamination in case of any presence of harmful substance. The pits will be fenced off within the compound and have floating safety ropes installed for safety reasons.

(8) Rig Move

Joint assessments were carried out by TR and ED for all possible routes to each well location. The assessment covered road width, intersections, bridges, community and public infrastructure. An assessment by TR, ED and transport contractors was carried out to determine the risks associated with rig move. As a result, roles and responsibilities were identified to assess and manage each rig move. The truck loads will not exceed 4.75 m in height and 4.4 m in width.

4.4.1.2 Drilling Operations

It is proposed to drill 1 well with a total depth of 2601 m (base case) and an option to deepen this to 3936 m either in this campaign or at some stage in the future. The proposed well design is based on geological and geophysical interpretation.

The Drilling operation will be conducted as per the well specific drilling programs as approved by ANPM. The procedures employed will be standard onshore oilfield best practice.

4.4.1.2.1 Pressure

An assessment of potential pore and fracture gradients is necessary for well control planning and protection of the targeted reservoir formations from damage. The formation pressure dictates the selection of BOP and surface control equipment pressure ratings and also the mud weights required to drill the well and maintain a safe over-balanced system. Excessive mud weights can cause the formation to fracture and losses of the mud system which could then result in underbalance and flow. Excessive mud weights can also cause invasion of potential reservoir sections and severely reduce deliverability/production potential.

Pore pressure and fracture pressure predictions have been calculated using offset well and seismic data within both PSC TL-OT-17-08 and PSC TL-OT-17-09, specifically:

- Drill Stem Tests
- Reported mud weights for kicks, flows and losses
- Shut-in pressures of pipe and annulus
- Sonic, density and resistivity wireline logs
- Seismic Interval Velocity
- Modelled fracture and overburden gradients

The accuracy of pressure prediction is controlled by the available data. The offset well database is of variable quality and at times lacking in detail.

No Leak-off (fracture initiation pressure) or Formation Integrity (set maximum pressure) Tests were recorded for any offset wells, so the calculation of fracture pressure is limited to indirect means (predominantly modelling and wireline log data).
The Pore and Fracture pressure (in mud-weight pounds per gallon "ppg") for the primary exploration locations are provided in Figure 4-4 and Figure 4-5 .

In order to optimise wellbore control, stability and integrity, a "best case" and "high case" estimate was calculated. As per standard procedure, these limits respectively are used to determine the drilling and kill mud weights for each interval.

"Best case" and high case" pore pressure predictions for both gas and oil cases are shown in Figure 4-4 and Figure 4-5 . The primary target at the Jurassic horizon and four deeper Triassic secondary targets are shown. There may be additional secondary targets below the primary target, but seismic imaging deteriorates with depth and these are not necessarily resolved in the reflection data. There are only two shallow well penetrations in PSC TL-OT-17-09, so consequently pressure prediction is loosely constrained. Whilst the presence of oil is the base case assumption in Rusa-1-1, the lack of offset well data in PSC TL-OT-17-09 makes it difficult to rule out the possibility of the presence of gas in this well. Consequently, a conservative approach has been taken and a gas case has been estimated as guide for highest case formation pressures expected and consequently a mud weight program has been designed to account for this scenario. Confidence in mapping of the deeper secondary targets is low, so whilst relatively low formation pressures are shown at these target levels these could be higher.

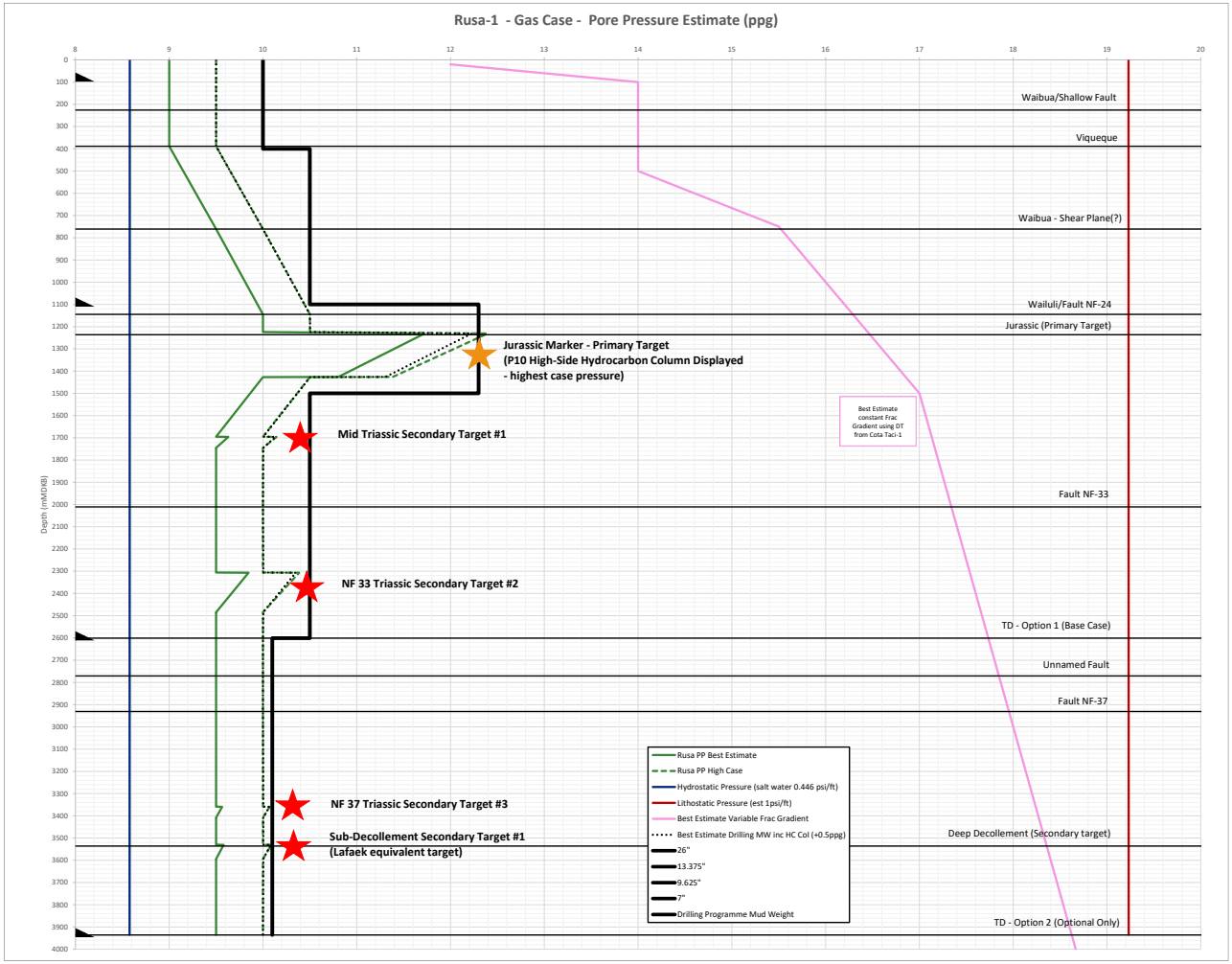


Figure 4-4. Rusa-1 Gas Case Pore & Fracture Gradient Prediction

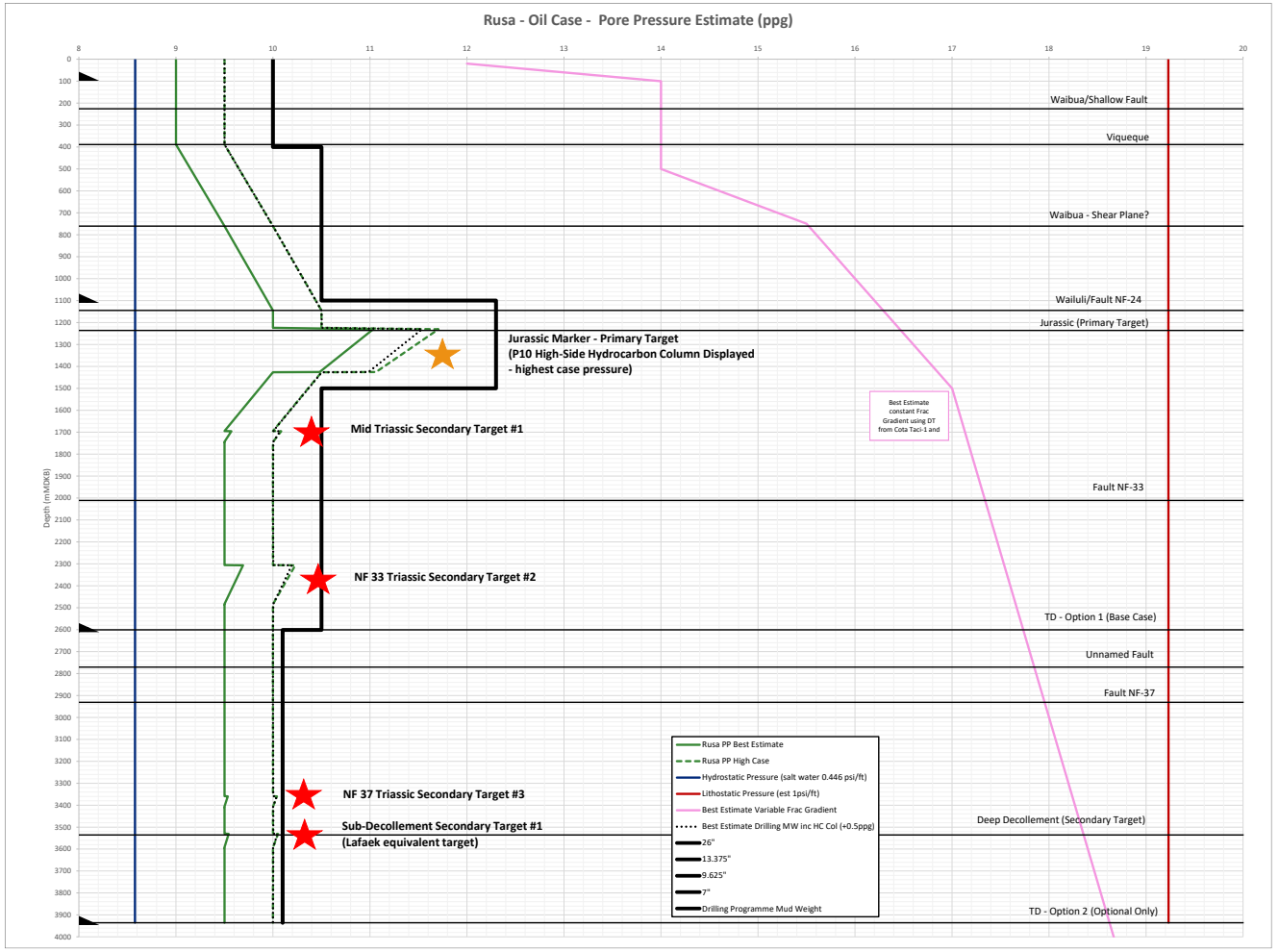


Figure 4-5. Rusa-1 Oil Case Pore & Fracture Gradient Prediction -1 Pore & Fracture Gradient Prediction

4.4.1.2.2 Mud System

In order to minimise environmental impact, non-toxic water-based muds will be utilised with typical properties as per Table 4-2 to Table 4-5 . All chemicals utilised in the project were subject to strict vetting by ANPM as part of the import requirements, a comprehensive checklist was completed and approved by ANPM in May 2020, a full MSDS database is maintained.

Table 4-2: Surface Hole - 26" (0-88 m)

Mud Type	Gel based Polymer
Mud Weight	8.5 - 9 ppg

Table 4-3. Intermediate Hole – 17 ½" (88-1100 m)

Mud Type	KCl/PHPA Polymer
Mud Weight	10-10.7 ppg
Plastic Viscosity	≤ 35 cP
Yield Point	16-24 lbs/100sq ft
Filtrate Water Loss	< 8 cc/30min
Mud cake	<1 (1/32in)
pH	9-10
Methylene Blue Test (MBT)	≤ 15

Table 4-4. Upper Production Hole – 12 ¼" (1100-2601 m)

Mud Type	KCl Polymer PHPA
Mud Weight	10.6-12.5 ppg
PV	≤ 35 cP
YP	18-28 lbs/100sq ft
API Filtrate/WL	< 6 cc/30min
API Mud Cake	<1 (1/32in)
pH	9-10
MBT	≤ 12.5

Table 4-5. Lower Production Hole (Optional Only) – 8 ½" (2601-3936 m)

Mud Type	KCl Polymer PHPA
Mud Weight	10.1-10.3 ppg
PV	≤ 35 cP
YP	18-28 lbs/100sq ft
API Filtrate/WL	< 6 cc/30min
API Mud Cake	<1 (1/32in)
pH	9-10
MBT	≤ 10

Potassium Chloride / Polymer muds are the most widely accepted water-based mud system for drilling water-sensitive shales, with PHPA (Partially Hydrolysed Poly Acrylamide) being the polymer.

The principal additives for a KCL-Polymer mud are:

Soda Ash - Sodium Carbonate (Na_2CO_3) is used to treat calcium ion contamination in the mud and Sodium Bicarbonate ($NaHCO_3$) cement contamination. Classed as low toxicity.

Caustic Potash - Caustic potash (KOH) is added for alkalinity control in a KCl-Polymer Mud rather than caustic soda because it provides pH control. Generally, a pH range of 9.5-10.5 is considered optimum for running KCl-Polymer muds. Low toxicity, caustic, harmful if swallowed or skin and eye exposure.

Bentonite - Pre-hydrated bentonite is used to viscosify KCl-Polymer Muds. Typically, concentrations of 5-15 lb/bbl of pre-hydrated bentonite are adequate for mud viscosity and filtration control. Not programed to be used in these wells.

Starch - Starch is added for filtration control in KCl muds. A modified starch (starch treated with a biocide) is preferred, generally potato-based rather than corn-based. Low toxicity.

PAC LV - is a low-molecular weight polyanionic cellulose polymer, which is an extremely effective filtrate reducer. Low toxicity.

XCD Polymer - is a high molecular weight Xanthum Gum biopolymer, used to viscosify water-based muds and completion fluids. It is primarily a viscosity modifier. Low toxicity.

Potassium Chloride (KCl) - Potassium chloride is used to inhibit clay hydration. Low toxicity.

Barite - barium sulphate ($BaSO_4$) is a commonly used to add weight to drilling mud. Low toxicity

PHPA - Partially hydrolysed polyacrylamide (PHPA) is primarily added to encapsulate solids and provide inhibition by interacting with bentonite to improve rheology. Low toxicity.

Drilling-fluid constituents can be grouped into several categories, depending on their function in the drilling-fluid system. The major categories are weighting (density control) agents, viscosifiers, thinners, fluid loss reducers and lost circulation material. There are also several minor groups of additives used for specific control such as lubricants, detergents, emulsifiers, defoamers, foaming agents, bactericides and corrosion inhibitors.

Density Control

The main density control agent will be Barite ($BaSO_4$). Commercially produced Barite normally contains 95% Barite ($BaSO_4$) along with some contaminants such as pyrite (FeS_2) and sphalerite (ZnS).

Like Calcium Carbonate, Barite is a naturally occurring biologically inert material with an extremely low toxicity when tested in simple mud systems (Hudgins, 1991).

Viscosity Control

The additives used for controlling fluid viscosity are organophilic clays such as amine treated bentonite clay or natural organic polymers such as starch, gum, xanthan, or guar gum. Viscosifiers serve a dual purpose in providing carrying capacity to the fluid and in developing a filter cake on the borehole to reduce fluid loss to the formation. Bentonite (sodium montmorillonite) is the primary clay used for viscosity; however, several other types of clays (attapulgite, sepiolite) can be used. In some applications, bentonite is treated with a small amount of water-soluble polymer to extend the viscosity-building properties of the clay, however these inert clays and polymers have very low toxicity (Jones et al., 1986). It is unlikely that Bentonite will be used in the drilling as a significant proportion of the section (Bobonaro - if encountered, Borolalo, Viqueque and Wai Bua formations) contains naturally occurring Bentonite.

Corrosion Inhibitor and pH Control

Drill pipe corrosion and scale can be serious problems. Corrosion of the drill string and casing during drilling can be caused by entrained oxygen within the mud or by acidic gases (CO, CO_2 and H_2S) produced during drilling. Corrosion is reduced by the addition of an oxygen scavenger such as Sodium Sulphite. Oxygen corrosion can also be reduced by maintaining the drilling fluid at pH >11 or by the addition of lime ($Ca(OH)_2$). This has the added advantage of stabilising the emulsions in the muds. Sodium Sulphite is also used in the food and pharmaceutical industries, it has low toxicity at the concentrations employed in the mud system (NCBI 2020).

Fluid-loss Reducers

If properly conditioned, drilling fluids should deposit a layer or filter cake on the wall of the borehole to help prevent liquid from the mud from entering the formation. These fluid-loss reducers are primarily the clays used for viscosity control, and material such as polymers. Both natural and synthetic polymers have been utilised as fluid-loss reducers.

Starch was one of the first polymers used, followed by sodium carboxy-methylcellulose (CMC), and several varieties of polyanionic cellulosic polymers, terpolymers and polyacrylates. The earlier natural polymers were subject to bacterial decay and required a preservative. The newer modified polymer systems are less susceptible to bacterial problems, and the need for preservatives in this regard has declined. The toxicity of the major polymers used today to control fluid loss (CMC, polyacrylates, etc.) is low-to-non-measurable (Jones et al., 1986 and Leuterman, et al.,1989).

Specialty Chemicals

Many commercial chemicals are utilised for speciality functions in drilling fluids including pH control (caustics), ion balance (potassium sources, carbonates), and corrosion control (zinc compounds). Most of the elements are naturally present in the environment and are used in limited quantities during drilling.

Lost Circulation Material

Lost circulation additives are primarily water-insoluble fibrous, filamentous, granular, or flaked material, with the most common materials used being nut shells and husks, mica and paper.

These naturally occurring products have not traditionally been bioassay-tested in drilling fluid systems because they are chemically inert and considered to be non-toxic at the level used. Any detrimental effect would be related to a mechanical, abrasive smothering action rather than chemical toxicity.

Specific-Use Additives

Lubricants are frequently utilised in water-based systems to reduce friction and prevent sticking. The traditional practice when pipe stuck was to pump a spotting fluid (50 to 100 barrels of No.2 diesel) into the stuck area to help free the drill string. The oil was later removed for separate disposal or mixed into the mud system as an added lubricant. Diesel spots have declined in use, because of regulatory constraints, and are being replaced by a variety of less toxic mineral oils. Lubricants containing oils can have relatively high toxicity levels. However, if used selectively and in moderation, regulatory compliance may still be met. A number of additives (e.g. emulsifiers, defoamers, surfactants, detergents, corrosion inhibitors and bactericides) are used at low concentration to impart specific characteristics to a mud or to treat problems. The toxicity of these products varies greatly; however, such a small volume is used that the toxicity of the overall mud system is low enough to meet regulatory compliance (Jones et al., 1986, Leuterman et al., 1989 and Hudgins, 1991).

Cement Chemicals

Portland cement is the largest component of the cement chemicals and is essentially made up of materials such as sand, alumina and bentonite clay, with calcium and sodium chloride occasionally present. These basically inert materials comprise about 97-98 % of the cement usage and discharge.

Some other categories of chemicals may be used to impart special properties to cements and are often placed deeper in the well where temperatures are higher. These chemicals are not normally discharged except as minor contamination in drilling mud. Minor amounts may be discharged when mixing systems are flushed.

4.4.1.2.3 Borehole and Casing Design

Safe Operation Principle

Well design will:

- Comply with regional laws, regulations, and best industry practice.
- Be designed to avoid drilling different formation pressures in same hole section.
- Be designed to have enough overbalance pressures to control well and to mitigate possible differential sticking mechanisms.
- Be designed to consider wellbore stability and/or weak/lost circulation formations.

Casing Setting Depth Principle

The first criterion of selecting casing setting depth is the overbalance pressure without fracturing shallow formations. Kick tolerance volume is also considered for determining the casing setting depth. The formation that has been cased, needs to withstand the operation of drilling, tripping in/out, and well control for the next hole section.

Economic Principle

To deliver reduced drilling time and cost, optimize hole sizes and subsequent casing sizes. Detailed planning of operational sequence and procedures also allow for cost savings, for example, using a liner hanger in combination with production casing to allow for contiguous testing of two intervals after reaching TD.

4.4.1.2.4 Well Design and Casing Selection

A 13 3/8" or 20" external/internal flush joint conductor casing will be set at approximately 88 m below the deepest known aquifer regionally, wells near Betano township encountered water between 14 and 35 m. The surface conductor will also cover possible unconsolidated river gravels and boulders in the top 50 m.

The proposed upper production (base case) and lower production (optional only) borehole casing setting depths are provided in the Table 4-6 below. The actual setting depth will be determined during drilling and subject to actual conditions encountered. The casing depths and sizes are designed to isolate sections based on pressure, presence of reservoir, consolidation of formation, kick tolerance and hole stability.

Leak Off tests (LOT) will be conducted at the previous section casing shoe prior to drilling ahead in new hole. Drilling mud weights will initially be based on pore pressure prediction and then adjusted to suit actual conditions. Static and dynamic (Equivalent Circulating Density) mud weights will be maintained as low as possible, whilst allowing for safety margins, to maintain overbalance without causing excessive formation damage. The upper limits of mud weight will be dictated by predicted and actual (from LOT) fracture pressure and casing strength (Table 4-7).

Kill muds of density less than the maximum fracture weight allowable for the hole section will be prepared and available should formation flow occur. Similarly, Lost Circulation Material (LCM) will be on hand to combat any downhole losses.

Table 4-6. Hole and Casing Setting Depths (target sections highlighted in green)

Hole Section	Hole	Casing	Depth (m MD)
Conductor	26"	20"	88
Surface Casing	17-1/2"	13-3/8"	1100
Upper Production Casing – Base Case	12-1/4"	9-5/8"	2601
Lower Production Liner - Optional Only	8-1/2"	7"	3936
Contingency hole	6"	4 1/2"	3936

Table 4-7. Casing Ratings Table and SF Calculated Load for Rusa-1

Hole (In)	Csg (in)	Grade	Weight (ppf)	Rating			Safety Factor Calculated Load		
				Collapse	Burst*	Body Yield	Burst	Collapse	Tension
17-1/2	13-3/8	K-55	54.5	1130	2730	853000	1.85	2.25	3.16
12-1/4	9-5/8	N-80	47	4754	6865	916000	1.11	1.03	2.45
8-1/2	7	L-80	29	7030	8160	1086000	1.16	1.01	1.60

*These are nominal burst pressures. For BTC connection

4.4.1.2.5 Well Casing Configuration

The borehole and casing design shown in Figure 4-6 has been determined by the geological interpretation and drilling engineering assessment and is subject to the down hole conditions encountered during drilling.

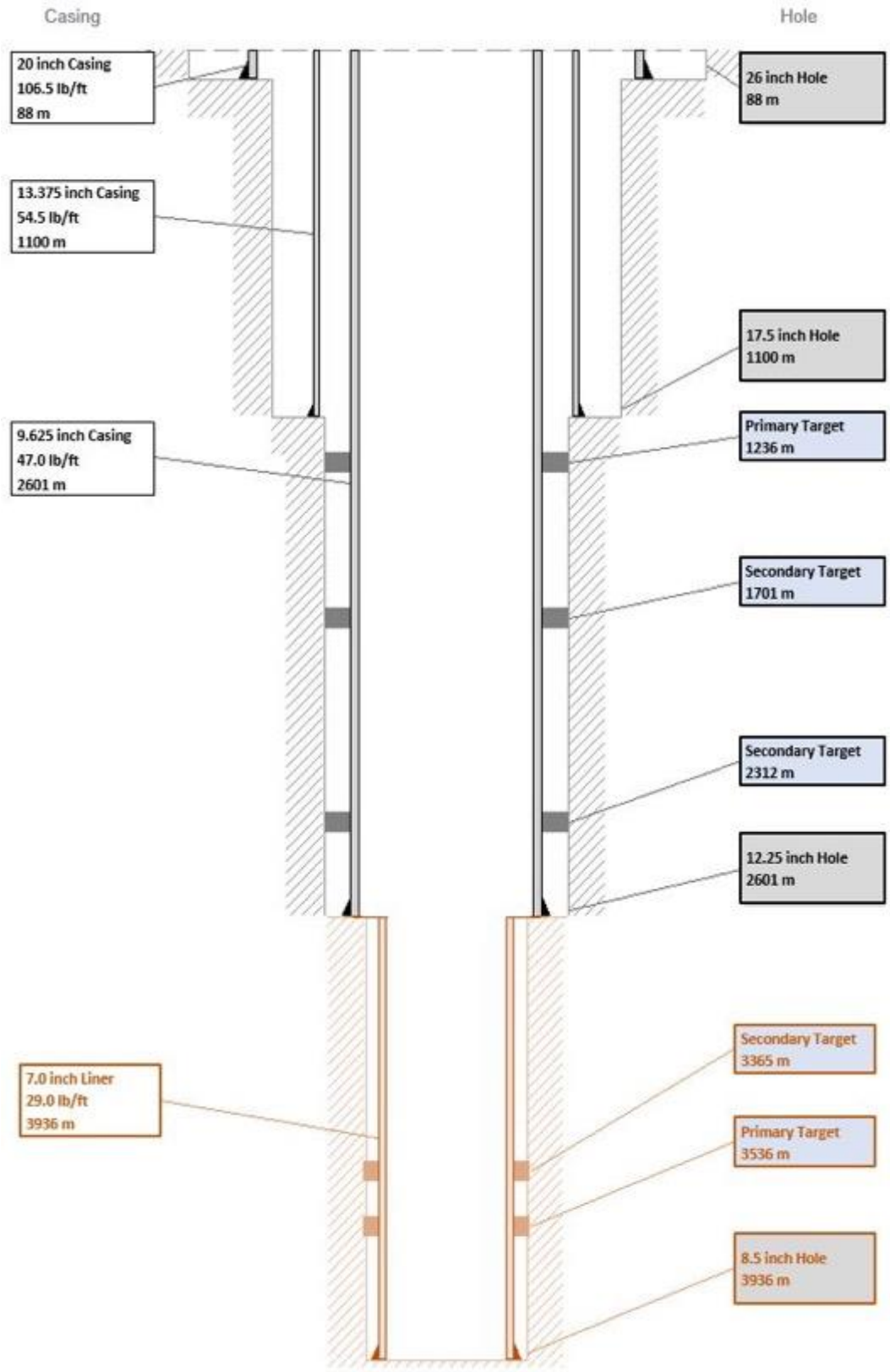


Figure 4-6. Rusa-1 wellbore and casing design schematic.
Base case borehole and casing design shown in grey and additional lower production interval (optional only) shown in orange.

Summarised Drilling Program

26" hole & 20" Conductor Casing

The objective of the conductor casing is to case the hole through the ground water, shallow aquifers, possible unconsolidated river gravels and boulders and altered limestones of the Borolalo formation that are found in the near surface. Based on water well data for aquifer depths in PSC TL-OT-17-08, the deepest regional aquifer was-found at 82 m.

Casing used for conductor will have external and internal flush joint and comply with API 5L, PSL-2 (Specifications for Line Pipe). A remedial cementing job (top up job) will be performed if there are no cement returns to surface.

17 ½" Hole & 13 3/8'' Intermediate Casing

The objective of intermediate casing is to isolate possible loss zones e.g. faults and the unstable clays of the Wai Bua and Viqueque formations, which are also likely to contain elevated pressures, before entering the target reservoir and to provide sufficient LOT and kick tolerance to safely reach next section TD.

There is limited offset well data in PSC TL-OT-17-09 (only 2 shallow wells), but these wells show that the shallow formations contain shale and/or clay. KCl will be added to the drilling fluid to inhibit swelling and bit balling.

The objectives for formation logging can be achieved by using electric line logging suites (electric logs, sidewall cores and pressure and fluid sampling), Directional surveys will be obtained with a combination of General-Purpose Inclinometry Tool (GPIT) and magnetic single-shot surveys for inclination and azimuth measurements. A mud motor will be available to correct for any significant deviation from a vertical hole.

Wiper trips and circulation ensure clean hole conditions prior to the logging operation. If necessary, the mud weight will be increased prior to logging, to maintain overbalance.

Casing grade is chosen to withstand the worst burst and collapse load scenario. Setting the casing seat as low as possible is required to provide an acceptable kick tolerance volume for well control operations.

Quality cementing operations will provide good isolation of well bore to surface. Cementing sequence and slurry weight are designed to prevent loss circulation during the cementing operations. The integrity of the cement will be confirmed by a wireline Cement Bond Log (CBL).

12 ¼" Hole & 9 5/8'' Upper Production Casing

The objective of the 12 ¼" hole section is to drill both the primary Jurassic reservoir target and possible Triassic secondary targets and run 9 5/8'' casing to surface. Two possible production hole sections are programmed to isolate the primary target interval (9 5/8'' casing) ahead of potentially drilling for deeper secondary targets - optional only (7" Liner- see below). The two production intervals are designed to reduce the risk of loss circulation into a formation with relatively lower pressure and to provide sufficient kick tolerance for the deeper targets.

Conventional cores will be acquired during the drilling of the interval. After reaching section TD wireline GR-Sonic-Resistivity-Neutron-Density-SP-Caliper log, Sidewall Cores and Pressure, tests will be run for formation evaluation. Fluid flow and sampling may be undertaken with a Wireline Formation Tester e.g. MDT in open hole or when this section is cased.

The casing will be cemented to surface and a CBL run to confirm integrity.
Further well testing operations may be considered in the event of a discovery.

8 ½ " Hole & 7" Lower Production Liner (Optional Hole Section Only)
The objective of the 8 ½" hole section is to drill the lower Triassic and Sub-Decollement reservoir target(s) and run a 7" liner with hanger set inside the $9^5/_8$'' casing shoe. The rationale for this configuration is to allow for the possibilities of perforation of both the upper and lower production intervals after reaching the deeper TD. If a full casing string was run to surface there would be two casings across the upper target which would preclude perforation and necessitate perforating and testing the upper target prior to drilling and casing the lower target.

Conventional cores will be acquired during the drilling of the interval. After reaching section TD wireline GR-Sonic-Resistivity-Neutron-Density-SP-Caliper log, Sidewall Cores and Pressure tests will be run for formation evaluation. Fluid flow and sampling may be undertaken with a Wireline Formation Tester e.g. MDT in open hole or when this section is cased.

The Liner will be cemented back to the hanger inside the $9^5/_8$'' casing.

Further well testing operations may be considered in the event of a discovery.

6" Hole & 4 ½" Liner – Contingency Only
Contingency is planned for a 6" hole section in the case where an additional primary casing size is required due to drilling conditions. The 6" hole section can be completed with 4 ½" Liner. The objective of using a liner hanger instead of long string casing is to minimize the wellhead sections.

After reaching section TD, wireline investigation will commence for the full suite of electric logs and pressure and fluid sampling will also be undertaken if required. Sidewall coring will not be achievable in the 6" hole size.

If the secondary target is proven to not be hydrocarbon bearing, the 6" hole can be plugged and permanently abandoned without running the Liner.

4.4.1.3 Suspension or Abandonment

After the well has been evaluated and tested a decision will be made to either Plug and Abandon (P&A) or Case and Suspend the well at the TD of 2601 m for further testing, or for future conversion to a production well, or to consider future re-entry and deepening of the well for the evaluate the deeper secondary targets identified down to 3936 m (if not drilled in this program).

If the well is deemed to not contain hydrocarbons cement plugs will be set to isolate any porous units, either in open hole or casing if perforated. The composition and length of the plugs will comply with industry standards and the P&A program as approved by the regulator. After the

well has been abandoned the well site will be rehabilitated, with a permanent marker placed at the surface hole location.

In the case that the well contains hydrocarbons that are commercial or could be commercial with further testing or appraisal well drilling, a suspension procedure will be carried out. The suspension will be approved by the regulator and may consist of temporary plugs, surface cap or wellhead ("Christmas Tree"). If future operations are not envisaged to require the full exploration drilling pad the well site area may be scaled down and the immediate area of the wellhead fenced off and secured.

4.4.2 Size of the Project

PSC TL-OT-17-09 has an area that covers 1,291 km^2, including 1,002.4 km^2 onshore extending along the coastline for approximately 52 km and up to 30 km inland, and 288.6 km^2 of the near offshore for an average distance of 6 km from the coastline.

The area required for the drilling campaign is 2.5 ha in total which includes an allocation of land for the well pad (approximately 1ha), mud pits, flare pit and areas allocated for earthworks drainage. In addition, TR will also build access roads from the nearest existing arterial or local road. The Betano base camp at Betano, previously used by Timor Resources for acquisition of the Fafulu 2019 2D seismic survey, is the central camp for crew during the drilling of Rusa-1 and occupies 1.3 ha. The existing Haemanu camp in PSC TL-OT-17-08 will support drilling activities as a regional supply base (Suco Labarai) and occupies 1.8 ha.

4.4.3 Location of the Project

The locations of the Rusa-1 wellsite and the Betano base camp are shown in Figure 1-1 and Figure 4-2 with the location access options shown in Figure 4-7 .

The Rusa-1 well is located in the Ainaro Municipality, Hatu-Udo Sub-district of Suco Foho-Ai-Lico and Aldeia Raimerlau. The proposed location is 3.4 km South of Daisua and is a 7.6 km North West inland from the nearest coastline town of Betano (Figure 4-2). The exploration drilling campaign requires the building of a wellsite and access roads from the nearest public roads at this location. A short-term rental payment will be negotiated with the landowner for the wellsite, where on private land

Timor Resources considered alternative surface locations based on the optimal subsurface target location for the well. Suitable alternatives required that the area be relatively level to reduce the impact of environmental impact of volumes of cut and fill in civil works operations, land use for cultivation and habitation, ownership dispute resolution. Viable alternatives were very few and based on these criteria there was no comparable alternative identified as part of this process.

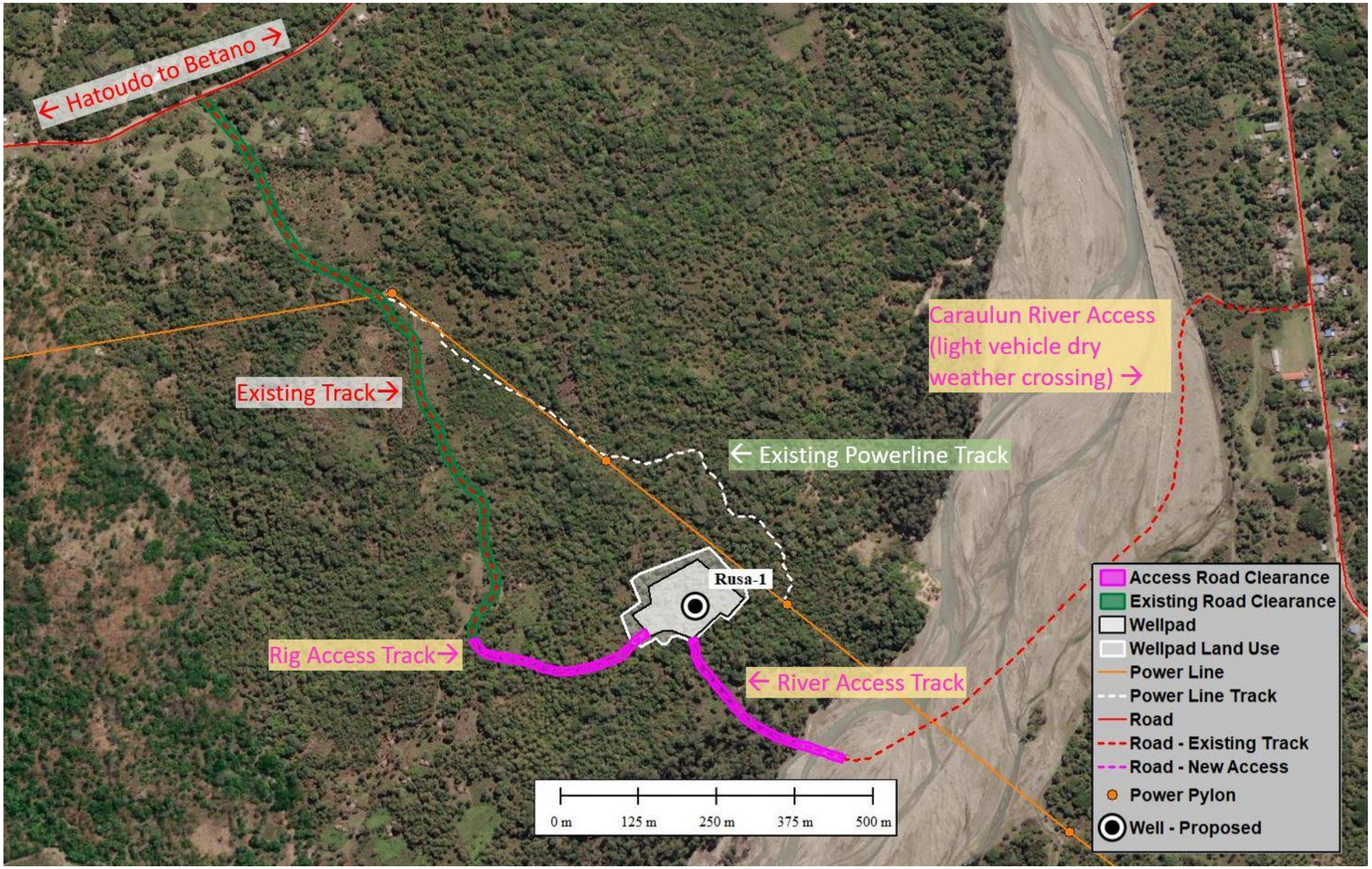


Figure 4-7. Rusa-1 wellsite and base case access routes

The Betano base camp is currently leased and located adjacent to the shoreline at Betano, it is the central camp for the Rusa-1 drilling operations and will provide accommodation for the off-duty workforce, canteen facilities and provision for the collection, segregation and disposal of waste and recyclable materials.

The Proponent will consider all aspects including aesthetic, socio-economic, environmental, safety and health issues when conducting the project activities. Infrastructure and operation requirements will be designed to comply with the legislation and industrial best practice.

Project Location Maps

Project maps covering the Rusa-1 drilling location, the Betano base camp and Haemanu supply base are provide in Figure 4-8 above and in Section 9.3.7 Noise Figure 9-4 and Figure 9-5 . Figure 4-8 covers an area of approximately 3 km radius from the well location.

The 350 m extent maps include road networks, the wellsite perimeter, urbanised areas and individual buildings and other infrastructure. An indication of the potential for the noise impact within the area is also shown. Air quality impact is not included as it is subject to ambient levels and environmental conditions such as wind speed and direction, this is covered in more detail in subsequent sections of this report.

The two map scales were chosen after assessment of zones of potential impact for the drilling program.

Drainage

A 30 m Satellite DTM was used to compute a watershed analysis for the wellsite (shown in Figure 4-8). The analysis provided the catchment area upstream of the wellsite and the direction of flow(s) away from the site. The drilling location will have berms to distribute surface water run-off around the site and minimize disruption of natural flow patterns. Surface water that falls on the site will be diverted to a watercourse on the downstream side of the well site. Catchment areas and downstream flow extent are provided . Table 4-8 .

Table 4-8. Catchment Areas and Outflow Length

WELLSITE	CATCHMENT (m^2)	DIVERTED OUTFLOW LENGTH (km)	NATURAL OUTFLOW LENGTH (km)
RUSA-1-1	2,551	0.052	11.24

Access

The primary access to Rusa-1 wellsite will likely be from the North West along the Hatu-Udo Road and then South along an existing track towards the wellsite.

Timor Resources is seeking approval for the access roads captured in Figure 4-7. Additional civil engineering and landholder discussions will form the basis of the most appropriate access for the project, when selected this land will be leased in the same manner as the wellsite. The access immediately West of the wellsite and veering North West is 1050 m of existing track (minimal additional clearing) and 311 m of new track to get to the gate at the wellsite (see Table 4-9). The route to access gravel for site construction is 324 m to access the Caraulun River immediately South of the wellsite, from this point a riverbed track to the North East can be used to access the Betano-Same road. The river crossing is restricted during heavy rainfall periods when the river

may swell in capacity and is likely to be restricted to light 4WD vehicles only. The clearance access roads will be 6 m wide and each clearance access route option will be +/- 50 m to allow for any change during clearing. Existing public infrastructure such as highways and local roads, bridges and underpasses have been assessed. If required, they will be upgraded or modified with approval of the relevant authorities to allow for the safe mobilization of the equipment to the project locations.

Table 4-9. Length and Areas of Access Roads

LOCATION	ACCESS ROAD LENGTH (m)	APPROXIMATE AREA (m^2)
RUSA-1 EXISTING TRACK	1,050	6,300
RUSA-1 NEW ACCESS TRACK	311	1,866
RUSA-1 WELL ACCESS TO CARAULUN RIVER	324	1,944
BETANO BASE CAMP	7	70
HAEMANU SUPPLY CAMP	8	80

Observations at Specific Locations

Rusa-1: The wellsite lies on a flat area, between two small natural watercourses on a generally south-easterly dipping slope. The catchment area draining to the wellsite is of limited extent (2,551 m^2) and will be diverted to the adjacent watercourses. Two knickpoints in the watercourses have been identified as suitable locations for spill containment of approximately 25,000 bbls if required.

The area surrounding the site has a low habitation density, noise and air quality impacts will be low and will be monitored.

The location is susceptible to access issues if operations were to be conducted in the wet season. The gradients on the Hatu-Udo road are high in places and could preclude movement of heavy equipment if on unsealed sections and wet.

Betano Base Camp: The camp at Betano has been operational from 2018 to the present day, during the seismic acquisition in 2019 the accommodation at the camp was more than 100 people. There has been no significant impact on the surrounding community since the camp was installed, this is expected to continue through the drilling operation.

Haemanu Warehouse and Yard: The noise levels from the yard will be low, the main contributions being from heavy vehicle movement (daylight hours only) and a small generator to provide camp power if the EDTL supply is interrupted.

4.5 JUSTIFICATION OF PROJECT

Timor Resources is a privately-owned Timor international oil and gas company that is in joint venture with TIMOR GAP (TG), the National Oil Company of Timor-Leste (NOC - TL). On the 7th of April 2017, TR engaged an agreement with the Timor-Leste Government permitting the company, with its partners, to begin the process of exploration, development, and exploitation of petroleum resources in the onshore contract area, identified as PSC TL OT-17-09.

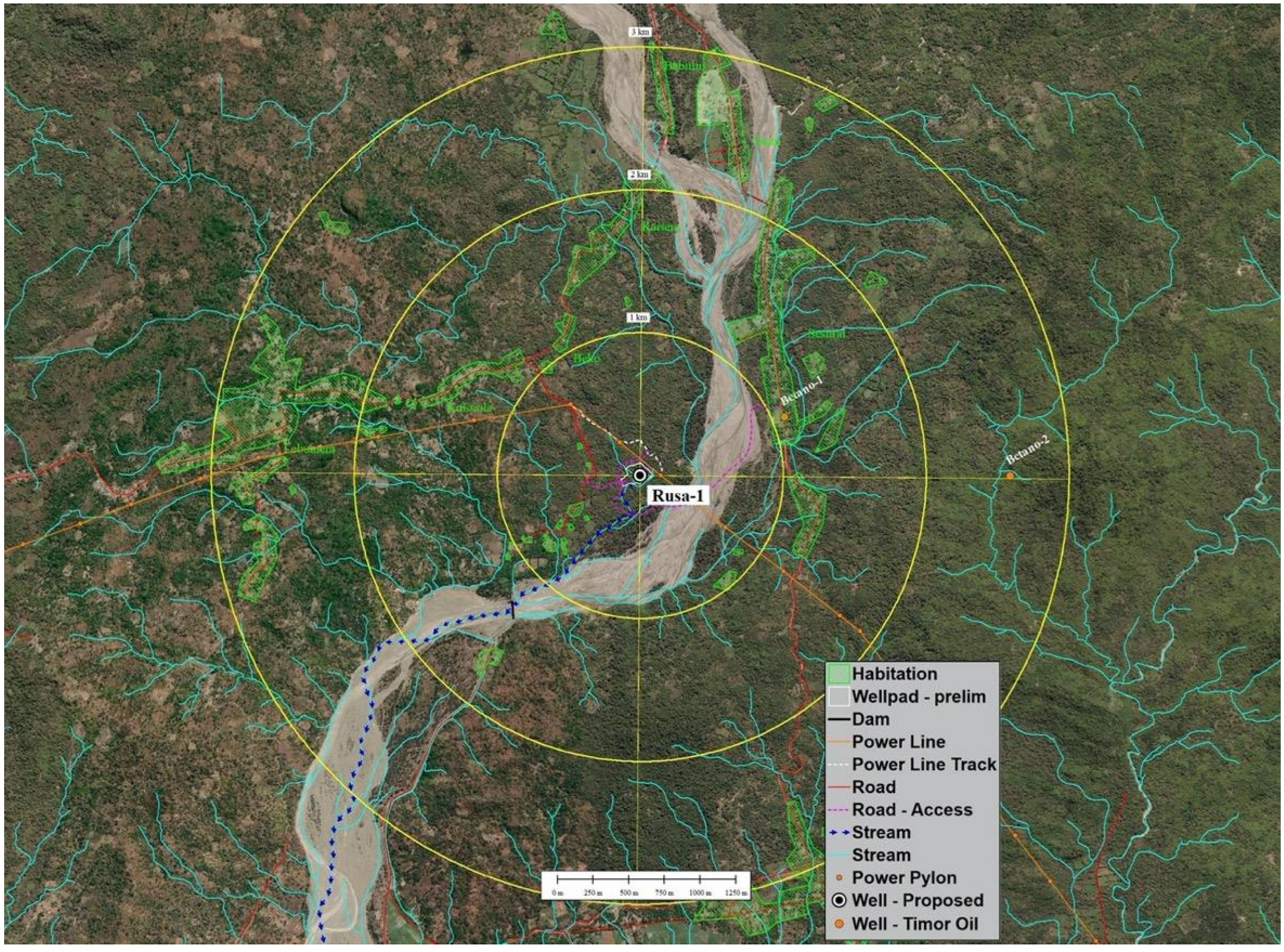


Figure 4-8. Rusa-1 Regional Area of Potential Impact

In assessing the petroleum prospectivity within the contract area Timor Resources has conducted extensive geological, geophysical and engineering studies including successfully acquiring two new 2D seismic surveys across PSC TL OT-17-08 and PSC TL OT-17-09 in 2018 and 2019, respectively. The interpretation of this data has led to the identification of number of leads, one of these Rusa-1 has been high graded to prospect status and is deemed drill ready. The next step is to drill the Rusa prospect with an exploration well to test the presence of hydrocarbons. In the event of success, the exploration drilling will need to be followed by later stage of appraisal drilling, likely multiple wells, in order to delineate the volume of the potential resource and assess its producibility i.e. how many wells and what type of completions will actually be required to produce a field to its maximum potential. These two phases of exploration and appraisal drilling are critical ahead of any final investment decision regarding a possible development future development. The exploration drilling of the Rusa-1 well will assess the presence of hydrocarbons in the Rusa prospect and will collect numerous data from the penetrated section including both physical and geophysical properties of the rocks and any hydrocarbons potentially encountered.

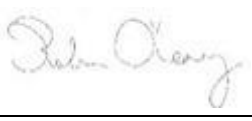
The Rusa-1 exploratory borehole is a minimum exploration work requirement for the joint venture for the First Period (Contract Year 3 – current year) of PSC TL OT-17-09.

Success in this phase of exploration drilling is a critical next step on the path to realise value for the joint venture, Timor-Leste Government, and the people of Timor-Leste. Timor Resources has invested time and effort in building local team capability and has already demonstrated the associated value in terms of local employment related to our activities, but also community projects that Timor Resources has committed to since country entry in 2017.

Timor Resources is committed to exploration drilling in PSC TL OT-17-08 and PSC TL OT-17-09 in 2021 and believes that these efforts made by Timor Resources will bring significant value to Timor-Leste well beyond the boundaries of these two PSCs and as such is recognised as project of national significance.

4.6 THE PROPONENT'S APPROVAL OF THE EIA

Timor Resources management approves the contents of this report and is committed to implement the controls, to the best of their ability, as contained herein.

Name	Position	Signature
Suellen Osbourne	Managing Director	
Robin O'Leary	Group General Manager	

4.7 EIS STRUCTURE

The EIS is prepared in accordance with the template provided in Annex 4 of the Diploma Ministerial No.46/2017 of the 2nd August. Hence, this EIS contents contain:

1. Executive Summary.
2. Details of the Project Proponent.
3. Details of the EIA consultants.
4. Description of the Project.
5. Policy, Legal, and Institutional Framework
6. Description of the Environment.
7. Climate Change.
8. Alternatives.
9. Impact Assessment and Mitigation Measures.
10. Social Impact Assessment.
11. Economic Assessment.
12. Summary of Environmental Management Plan.
13. Public Consultation and Information Disclosure.
14. Difficulties encountered.
15. Conclusions and recommendations; and
16. Non-Technical Summary.

5 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

5.1 LEGISLATION

Applicable national legislation and industry guidance are referenced in Table 5-1 provides a summary of the principal legislation and regulations applicable to the project, in addition the table includes relevant International and Industry Guidance that has been consulted in the course of the study.

Compliance with the two key regulatory instruments relating to environmental management, that is Law 5/2011 on Environmental Licensing and Law 18/2020 on Onshore Petroleum Operations, particularly in regard to Chapter XVII on Environmental Affairs Articles 138 to 160.

Compliance and assurance are managed through TR Operating Management System implementation as described in Section 5.2.2 below.

Table 5-1. National Legislation and International and Industry Guidance Documents

TITLE	DESCRIPTION	RELEVANCY TO THE PROJECT
Timor-Leste National Legislation and Regulation		
Constitutions of the Republic Democratic of Timor-Leste Article 61 (Environment)	The article specifies provisions for state including the proponent shall undertake to defend, and safeguard the environment recognizes the right of all citizens to a humane, health and ecologically balances environment while also specifying the duty of everyone to preserve and protect the environment for the benefit of future generation	Provide the basis for environmental protection and safeguarding in the Country
Environmental (Licensing) Decree Law No.5/2011	The procedure for directing the environmental assessment, the review of application for environmental license, issuance and renewal of license. • Categorization of the project category according to severity of the environmental impacts. • Procedures and information requirement for Category A project • Organization and composition of the review committee and its duties and responsibilities. • Specific provisions for public consultation and the protection of the traditional customs and cultural practices. • The issuance of the decision by the Environment Authority on the review of the application and the rights of the project owner to appeal the decision.	Provides the Environmental Licensing procedure to regulate actions to encourage and protect the nature as an important instrument for sustainable development of economy of Timor-Leste
Decree-Law No. 6/2020, of 6 February 2020	Complements the Protected Areas National System, and the Environment General Framework sets forth the legal framework applicable to conservation of biodiversity and sustainable use of its components. The main goal of this statute is to promote the conservation of biodiversity and the sustainable use	Promotes the conservation of biodiversity and the sustainable use, and sets the principles which stakeholders must

	of its components and the fair and equitable distribution of the benefits generated from genetic resources, as a fundamental component of family subsistence, food safety and the welfare and health of present and future generations. For this purpose, the statute also sets forth the principles which the various stakeholders must comply with and the rules on interaction between public entities.	comply with and the rules on interaction between public entities.
Decree Law No. 5/2016 – National System of Protected Areas (Annex 1 – List of Timor-Leste Protected Areas)	This Decree Law defines the norms and principles for the creation of the national system of terrestrial and marine protected areas, for the classification of protected areas and for the approval of the applicable management instruments, according to the international best practices, in the matter, duly adapted the national reality, without forgetting the important role of community authorities and existing customs.	Provide the basis for the protection of the terrestrial and marine protected areas without putting aside the important role communities, authorities and existing customs.
Decree Law No. 3/2012 on Basic Environmental Law	The Decree Law identifies the protection of the environmental life and wildlife protection, including the basic principles for the conservation, preservation and sustainable use of natural resources in order to improve the quality of life of the local populations.	Communicate to the communities by providing information on the basis for the protection of environment and wildlife protection and sustainable use of natural resources through public consultation
Diploma Ministerial No.44/2017 – Impact Benefit Agreement	The article specifies the process for the agreement between the project proponent and the local community regarding the advantages and disadvantages of the project	As this is a category A project, the IBA will be implemented if it proposed by a member of community to ensure local or community's interest is considered and agreed proposal shall be implemented
Diploma Ministerial No.45/2017 – Rules and Procedures of the Evaluation Committee for Project with Category A	The article specifies the importance of establishing rules and procedures for the evaluation committee for the management of the environmental evaluation process for projects in category A	Establishment of a committee in order to review the project that categorise into category A.

Diploma Ministerial No.46/2017 – Detail requirements of Classification, Initial Assessment and Terms of Reference, Environmental Impact Statement and Environmental Management Plan	The article specifies the necessary of establishing a regulation to regulate projects that may have significant impacts on the environment, while also specifying the procedures and requirements to select projects that classified into category A, B and C.	Provides the environmental licensing and classification of the project into category A.
Diploma Ministerial No.47/2017 – Public Consultation Procedure and Requirement during Environmental Baseline Process	This Diploma Ministerial specifies the procedures and requirement of involvement of public and communities into different stages of the environmental assessment process through public consultation.	Provides information and communicate to the communities by providing information on the basis for the protection of environment and wildlife protection and sustainable use of natural resources through public consultation
Decree Law No 27/2020 dated 19 June Organic Law of VIII	Constitutional Article 33 (c) (Minister of Petroleum and Minerals) responsibilities item (o) Considering the complexity and technical expertise of the oil and mineral resources sector, conduct the respective environmental licensing procedures and approve the corresponding environmental licenses in that sector	Provides a description of legal framework that empower Ministry of Petroleum and Minerals to issue environmental license.
Decree-Law No.18/2020 Onshore Petroleum Operations	Applies to Onshore Petroleum Operations including transportation, processing and storage of Crude Oil and Natural Gas with direct impact on any reservoir. In addition covers a broader scope of issues related with onshore activities, notably a legal statute that also addresses environmental and technical aspects related with the carrying out of onshore Petroleum Operations, such as rights of way through, on or over the land destined for Petroleum Operations, installation of pipelines, rules on geological, geophysical or geochemical surveys, environment. This Decree-Law No.18/2020 of 13 May also stipulated on matters pertaining to means and ways of intervention, expropriation, nationalization and privatization of means of production and land on grounds of public interest, as well as criteria for the establishment of compensations in such cases,	Provides the fundamental legal framework for all oil and gas operations onshore Timor-Leste

	including the appeal to the Government in case of any land dispute occurred.	
Forestry, Aquaculture and Fishing Legislation: Law No. 14/2017 – General Regime of Forestry	The article outlines the basic principles and standards for the management, protection, conservation and sustainable use of forestry and river basin resources. Moreover, it describes the importance of communities that utilise the forests to their need and prosperity and promoting sustainable development	Provide legal framework of the fundamental norm of the environmental protection and preserving the natural resources existence in the forests for sustainability of the economic development
Labour Legislation Law No. 4/2012 – Timor-Leste Labour Code	This law describes the rights between employers and workers in regard to the working hours, leaves, remunerations, compensations and health and safety welfares	Provide basis for the project proponent to set up a working condition and contracts between employer and employee
Land legislation Law No. 13/2017 - Especial Regime for the Definition of Land and Property	This law provides legal jurisdiction of the owners of lands and the individual rights of their private properties according to the Article 54 (1) of the RDTL Constitution	As the legal basis for the project proponent to identify, access and compensate for any land used during the project activities
Waste Management Decree Law No.33/2008 – Hygiene and Public Order Decree Law No. 2/2007 – Urban Residual Waste Management	This law provides legal framework to manage the urban solid waste and ensure promoting the hygiene in the workplace	As the legal basis for the project proponent to manage solid waste are produced during any project phase. This to be set as the minimum criteria for the TR to establish its own waste management system
Cultural Heritage Legislation: Government Resolution No.25/2011 – Protection of Cultural Heritage (Annex 4)	This Government Resolution is used to protect and preserve Timor-Leste's cultural heritage until the Cultural Heritage National Law is made available. The resolution defines the type of the cultural heritages; archaeological heritage, architectural heritage, ethnographic and traditional heritage and intangible heritage	The resolution provides scope or boundary of the cultural heritage which has to be considered by project proponent.
International and Industry Guidance Documents		
Western Australian Department of Mines and Petroleum "Guidelines for the	Provide Guidelines for the development onshore OSCP Provide mitigation measures to oil impacts sourced from the drilling activity.	Provide Guidelines for the development onshore OSCP Provide mitigation measures to oil impacts sourced

Development of an Onshore Oil Spill Contingency Plan 2016"		from the drilling activity.
International Finance Corporation Environmental, Health and Safety Guidelines for Onshore Oil and Gas Development; April 30th, 2007	The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice. The guidelines are industry specific for onshore oil and gas and are designed to be used together with the General EHS Guidelines document (see below), which provides guidance to users on common EHS issues potentially applicable to all industry sectors.	Provide guidance on the application of good environmental practice.
International Finance Corporation Environmental, Health and Safety General Guidelines; April 30th, 2007	The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice.	Provide guidance on the application of good environmental practice.
United Nations Convention on Biological Diversity (UNCBD)	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: 1. The conservation of biological diversity 2. The sustainable use of the components of biological diversity 3. The fair and equitable sharing of the benefits arising out of the utilization of genetic resources	Timor-Leste is rich of the biodiversity with significant ecosystem and endemic species. The country signed the convention in 2001. As the project could have impacts on the flora and fauna or risk to the loss of the biodiversity, it is fundamental principle for the project proponent to prevent or minimise the risk of biodiversity loss during the project implementation
United Nations Framework for Climate Change Convention (UNFCCC)	The United Nations Framework Convention on Climate Change (UNFCCC) provides a framework for intergovernmental efforts to reduce greenhouse gas emissions and adapt to the expected impacts of climate change. It also provides guidance to member states on developing and implementing national climate change strategies, incorporating both adaptation and mitigation actions. Timor-Leste became a signatory to the UNFCC in October 2006.	The project activities release GHG emissions which could be one of the contributing factors to the country's climate change issue. Minimisation climate change risks by reducing the GHG emissions are an

		essential part of the project environmental objective and target. This convention is the principle guidance for the project proponent to prevent the air pollutions and reduce the GHG emissions as much as possible.
IOGP Guidelines	The International Association of Oil & Gas Producers (IOGP) is the voice of the global upstream industry. Oil and gas continue to provide a significant proportion of the world's energy to meet growing demands for heat, light and transport. IOGP Members produce 40% of the world's oil and gas. They operate in all producing regions: the Americas, Africa, Europe, the Middle East, the Caspian, Asia and Australia. IOGP serve industry regulators as a global partner for improving safety, environmental and social performance and act as a uniquely upstream forum in which Members identify and share knowledge and good practices to achieve improvements in health, safety, the environment, security and social responsibility.	Provide oil and gas industry specific guidance on the application of good environmental practice.
IPIECA Guideline	IPIECA is a not for profit association that provides a forum for encouraging continuous improvement in industry performance. IPIECA is the only global association involving both the upstream and downstream oil and gas industry. It is also the industry's principal channel of communication with the United Nations. IPIECA develops, shares and promotes good practice and knowledge to help the industry and improve its environmental and social performance. We do this with the understanding that the issues that dominate the sustainable development agenda – climate and energy, environmental and social issues – are too big for individual companies to tackle alone. The industry must work together to achieve improvements that have real impact. IPIECA helps to achieve this goal.	Provide oil and gas industry specific guidance on the application of good environmental practice.
Forestry, Aquaculture and Fishing Legislation: International Union for Convention of Nature (IUCN)	This international convention is and international organisation focus on the nature conservation and sustainable of utilising the natural resources. The IUCN works in the field to promote ecological conservation in order to ensure the sustainable development concepts.	Timor-Leste is a signatory member of the IUCN convention which has responsibility to protect its ecological components to ensure

		the economic sustainable development. Therefore, baseline survey is used to identify all species categories listed under the IUCN red list which can be impacted by the project activities
Cultural Heritage Legislation: UNESCO Convention on Natural and Cultural Heritage	The convention mandates each signatory party to identify, protect, conserve, transmit and present to the future generations of the cultural and natural heritage	As the Timor-Leste is a signatory member of this convention therefore this project activities ensure the protection and conservation of any cultural and natural heritage around the project locations
Noise and Vibration Standards and Regulation: WHO guideline for community noise	This WHO guideline is used to measure the noise level around the community areas and ensure the protection of people from discomfort environment and potential noise induce hearing loss	This guidance is used to ensure the noise levels arising from the project activities are contained or maintained between the WHO set values to protect everyone at or near the project locations are affected by unwanted sound caused by the project activities.
Air Quality Guidelines: WHO Air Quality Guidelines	WHO Air Quality Guidelines (AQG) offer guidance on threshold limits for key air pollutants that pose health risks and provide a reference for setting air pollution targets at regional and national levels to improve air quality. Air quality guidelines have been published by WHO in 1987 and they were revised in 1997. The 2005 update represents the most current assessment of air pollution health effects, based on an expert evaluation of the scientific evidence. The guidelines offer recommended exposure levels for particulate matter (PM10 and PM2.5), ozone, nitrogen dioxide and sulphur dioxide, as well as a set of interim targets to encourage a progressive improvement in air quality.	The air quality benchmark is used as reference by the project proponent is the WHO air quality guidelines.

Climate Change Kyoto Protocols Government Resolution of National Action Plan for Climate Change	Kyoto Protocol is an international treaty which extends the UNFCCC parties commitment to reduce the green house gas according to the scientific consensus. The protocol implements the objective of reducing the global warming potential gas in the atmospheres. The government resolution of national action plan for climate change (NAPA) is the first national document that identifies urgent and immediate climate change adaptation needs of the most vulnerable groups. It provides a starting point from which climate change adaptation can be mainstreamed into development plans as a key strategy for attaining sustainable development and poverty reduction (MDG, 2010).	Timor-Leste is the signatory party of the Kyoto Protocol which shall ensure the implementation of the protocol in order to reduce the GHG emissions.
Water Resources WHO 2008 Guideline for Drinking Water Quality	These guidelines is used as the reference for the Timor-Leste to ensure drinking water quality according to the WHO drinking water quality standard	As the guidance for the project proponent to test and ensure water quality around the proposed project locations before any drilling activities are taken place

5.2 TIMOR RESOURCES HSE POLICY AND OPERATING MANAGEMENT SYSTEM

5.2.1 Timor Resources HSE Policy

Timor Resources

Health, Safety & Environment Policy

Timor Resources is committed to achieving incident free operations through the provision of effective Health, Safety and Environmental (HSE) Management across all of its operations and worksites for the benefit of employees, contractors and the community. The Company is committed to:

- Promoting HSE objectives, leadership, responsibilities and behaviour as an integral part of the duties of management and all employees;
- Complying with applicable laws and other obligations and requirements that the company subscribes to, and where adequate laws do not exist, adopting and applying standards that reflect Timor Resources commitment to HSE outlined in this policy;
- Reporting and evaluating risks, threats, hazards and impacts to company operations that have the potential to adversely affect the environment or the health and safety of employees, contractors or the community;
- Implementing appropriate control and contingency measures to prevent pollution and minimise and manage these risks, threats, hazards and impacts to an acceptable level;
- Establishing and ensuring that standards are followed, and effective practices promoted to ensure that the environment, people, property and information are protected from harm;
- Selecting and engaging contractors whose management systems are acceptable to Timor Resources and whose commitment to this policy is clearly and continuously demonstrated;
- Providing competent human resources to manage relevant aspects of health, safety or environment;
- Communicating openly with all stakeholders on HSE related issues;
- Providing training, instruction and supervision to personnel to enable them to attain the knowledge and skill levels necessary to perform their work incident free;
- Maintaining appropriate contingency arrangements;
- Continually monitoring, reviewing and improving HSE performance and associated management systems so that our activities can continue without interruption;
- Ensuring that oversight of accident, incident and near miss investigations is assumed by the appropriate executive manager and that those investigations are conducted to a level of detail that is appropriate to the event's actual and potential severity, and;
- Ensuring a consistent and equitable approach to the management of the health of the employees and the communities.

Every employee and contractor working for the Company has a responsibility to promote a culture whereby their actions and those of their colleagues are consistent with this Policy.

Suellen Osborne
Chief Executive Officer
2nd April 2020

HSE Policy TR-GEN-POL-00-000-001 Updated 2nd April 2020

5.2.2 Timor Resources Operating Management System (OMS)

The following section describes Timor Resources Operating Management System and demonstrates how the company will comply with such laws and regulations referred to in Table 5-1 above.

TR is committed to achieving incident free operations through the provision of effective HSE management across all of its operations and worksites for the benefit of employees, contractors and the community, this is achieved through application of the Company's Operating Management System (OMS). The eleven Elements of the OMS are shown in Figure 5-1 and is based on the international standard **PLAN-DO-CHECK-ACT** PDCA cycle, and the Eastern Drilling HSE MS is gap assessed against the OMS requirements below.

TR will follow the OMS and PDCA cycle throughout the project and ensure performance through the Environmental Management Plan (EMP) which is appropriate to the nature and scale of the project and the impacts identified and summarised in this EIA by:

- Adopting a mitigation hierarchy to anticipate, avoid, minimise and, where residual impacts remain, offset impacts to the environment and affected communities.
- Ensuring that all grievances from the community are responded to and managed appropriately.
- Promoting and providing adequate engagement with communities throughout the project on issues that could potentially affect them and ensuring that relevant information is disclosed and shared.

The EMP will outline the actions and outcomes required to address the issues raised in the EIA, and include performance standards, targets and time frames, and assigning responsibilities for implementation.

The mitigation measures identified for the management of potential environmental impacts will be integrated into the project design through the OMS. Implementation will follow Timor Resources HSE Policy and the OMS and meet Timor-Leste legislation and regulations, in particular, Environmental Basic Law No 26/2012, Environmental Licensing Decree Law 5/2011 (and supporting Ministerial Diplomas 45/46/47) and Decree-Law No.18/2020 Onshore Petroleum Operations.

TR ensures compliance with the legislative and regulatory regime in Timor-Leste through the implementation of the OMS, in particular TR will fully implement Law 5/2011 in regard to the Environmental Licensing requirements and the subsequent implementation of the approved Environmental Management Plan. Simultaneously through the OMS TR will comply with all elements of Law 18/2020 on Onshore Petroleum Operations, particularly in regard to Chapter XVII on Environmental Affairs Articles 138 to 160.

Compliance and assurance are managed through implementation of the following elements :

- Element 7 Operational Controls:
  - Health, Safety and Environmental Management
  - Management of Change
  - Contractor and Purchasing Management
  - Asset Integrity, Engineering and Project Management
- Element 9 Crisis and Emergency Management
- Element 10 Assurance
  - Inspection and Audit
  - Non-Conformance Corrective and Preventative Action
- Element 11 Performance and Compliance

Full details are provided in the EMP and a summary of the key elements are included in Section 12.

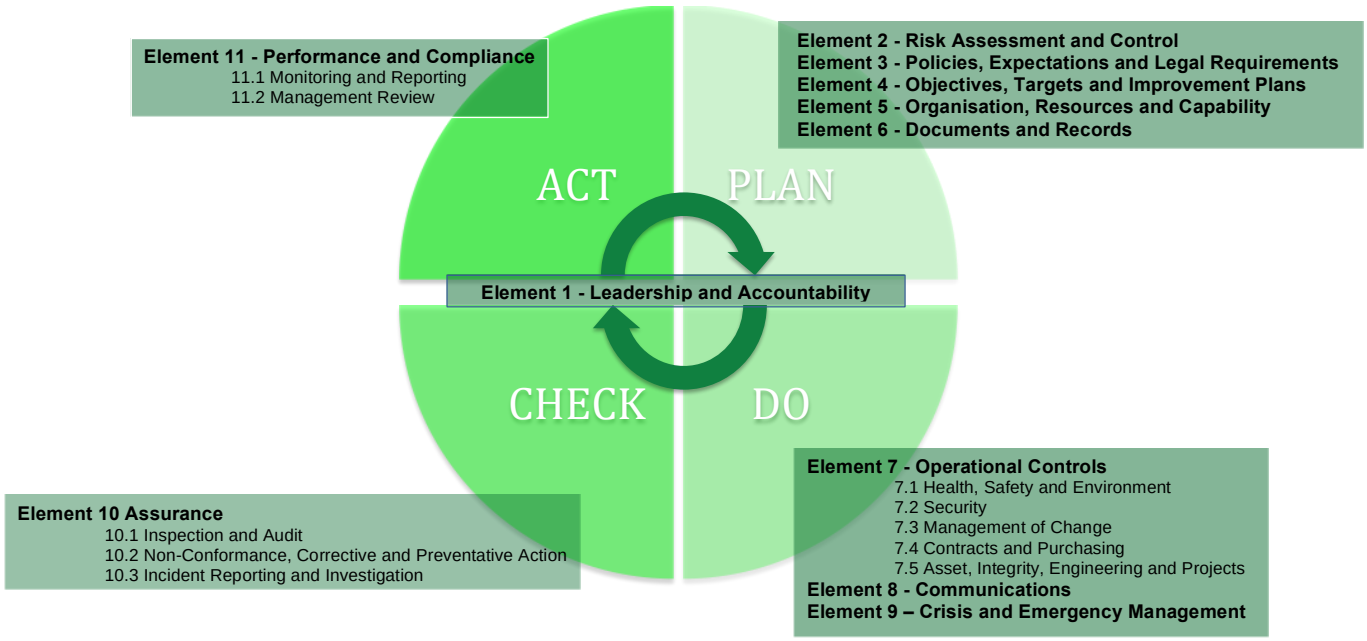


Figure 5-1. Timor Resources Operating Management System (OMS)

6 DESCRIPTION OF THE ENVIRONMENT

This section provides the description of not only the related environmental components, but also economic, social and cultural aspects that could be potentially impacted by the proposed project development. The description will also provide the method of study, the literature review used for the study and the scope and limitations of the environmental aspects studied during the EIA.

6.1 PHYSICAL COMPONENTS

6.1.1 Climate

6.1.1.1 Literature review

There is limited climatic literature to describe the climate condition of the drilling area.

The following are the documents or information sources used for the assessment:

- Climate change knowledge portal – Average monthly temperature and rainfall in Timor-Leste from 1901 – 2016 (World Bank Group, 2020)
- Country Report: Climate Risk Management in Timor-Leste (UNDP, 2013)
- Historical monthly weather data – www.worldclim.org/data/monthlywth.html
- Tasi Mane Project - Betano Petroleum Refinery and Beaço LNG Plant– EIS study (WorleyParson, 2012a)
- Tasi Mane Project - Suai Supply Base – EIA report (WorleyParson, 2012b)
- Map of annual rainfall and temperature in Timor-Leste: Seed of life organization http://seedsoflifetimor.org/wp-content/uploads/2013/01/Rainfall-Map-With-Graphs.pdf
- Australia Bureau of Meteorology Australian Tropical Cyclone database: http://www.bom.gov.au/clim_data/IDCKMSTM0S.csv
- Country Report Presentation: Southeastern Asia-Oceania Flash Flood: http://www.wmo.int/pages/prog/hwrp/flood/ffgs/saoffg/presentations/scm1/Countries/TimorLeste.pdf (DNMG, 2017)
- Country Report: Strengthening the resilience small scale rural infrastructure and local government system to climatic variability and risk (UNDP & GEF, 2013): https://www.undp.org/content/dam/timorleste/docs/reports/ENV/Prodoc_UNDP%20GEF_SSRI.pdf
- Timor-Leste, Agro-Climate outlook: WFP (2020): https://docs.wfp.org/api/documents/WFP-0000113397/download/

6.1.1.2 Study Scope and Limitations

The study area extends beyond the immediate drilling area, due to the lack of local climatic data sources, in order to obtain greater resolution of the data accuracy, most of the data have gaps in between a recording period.

6.1.1.3 General Description

Timor-Leste is typical tropical country with every part of the regions experience monsoonal climate with distinct wet and dry seasons. The wet season typically runs from December to April, and dry season is from May to November and within the regions, seasonal temperature is varied with diurnal temperature often greater than seasonal. The average high temperatures range from 24°C in dry season to 26.3°C in wet season (World Bank Group, 2017). Figure 6-1 below

shows the temperature ranges over the twelve months periods, which runs from dry to wet seasons.

The climate temperature in Timor-Leste is driven by the West Pacific Monsoon and its rainfall largely regulated by the Asian Monsoon, such as El Niño, La Niña, Indian Ocean Dipole (IOD), Maden-Julian Oscillation (MJO), altitudinal and coastal effects; and these Asian-West Pacific Monsoon have been associated with the variability of inter-annual rainfall and dry season rainfall as well as the huge temperature difference between the land and ocean (UNDP, 2013). The effect of this Asian-West Pacific Monsoon is varied within every part of the region within the country.

Figure 6-1 also show the rainfall conditions over the twelve months recording period, this rainfall information however, would not be further detailed or elaborated under this section of this EIS document. As this is in accordance with the Timor Resources approved Terms of Reference for the proposed project.

Timor-Leste's climate is affected by the West Pacific Monsoon November to April Figure 6-2 which is driven by large differences in temperature between the land and the ocean. It moves north to mainland Asia during the Southern Hemisphere winter and south to Australia in the Southern Hemisphere summer. Its seasonal arrival usually brings a switch from very dry to very wet conditions. The normal south-easterly trade winds in Dili are replaced by westerly winds from the monsoon onset until the end of the monsoon season. The arrows show near surface winds, the blue shading represents the bands of rainfall convergence zones, the dashed oval shows the West Pacific Warm Pool and H represents typical positions of moving high pressure systems

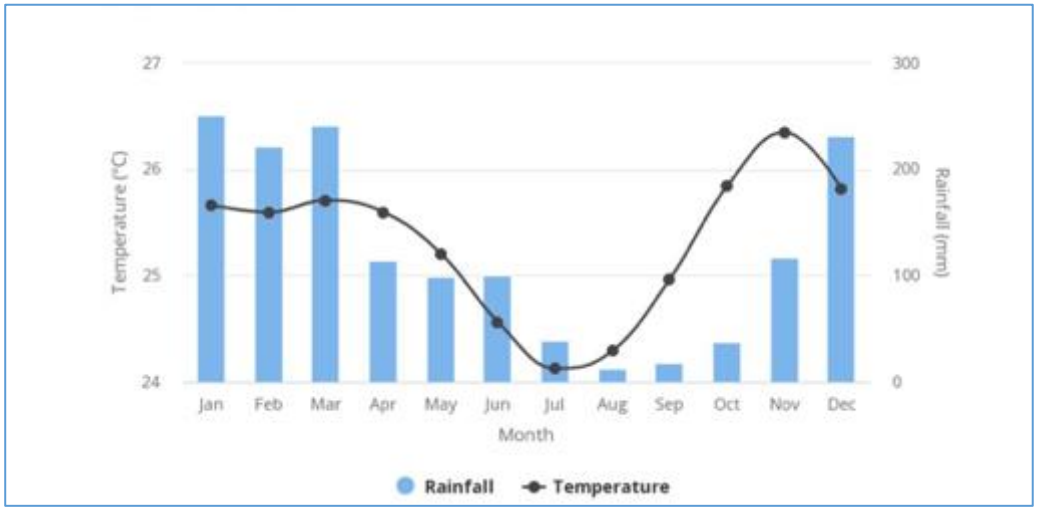


Figure 6-1. Temperature reading over 12 months of the year in Timor-Leste
Source: (World Bank Group, 2017)

The Timor-Leste monsoon climate has a differential effect between the North and South of the country. The northern part of the country, influenced by the Northern Monomodal Rainfall Pattern, has a 4-6 month wet season from November to April or June. The southern part experiences the Southern Bimodal Rainfall Pattern leading to a seven to nine month wet season with two peaks, one in December and the other in May (Figure 6-2) (Barnett, Dessaj, & Jones, 2007).

6.1.1.4 Temperature

Temperature data was collected at the same points as the sensitive receptors where the air quality and noise samples were taken, these are shown in Table 6-3, Figure 6-30 below.

Based on the survey results the temperature measured at the drilling area, were shown to be between 31ºC and 33ºC on average. This survey temperature results are consistent with the UNDP (2013) annual mean temperature of the country at the flat and highland areas see Figure 6-3 shows the mean temperature ranges from less than <21ºC to >27ºC across the country of Timor-Leste. The map also indicates that the temperature increases towards the flat area and decreases towards the highland area.

Furthermore, in accordance with the UNDP (2013), the minimum temperature is usually occurred during the month of July and August; and the maximum temperature would be generally experienced during the month of October to December.

These temperature presented in the map above are also consistent with the World Climate Data (2020) graphs that show a similar pattern of temperature reading for all the drilling area. The global climate has maximum and minimum temperature reading of the drilling area from the year 2010 until 2018.

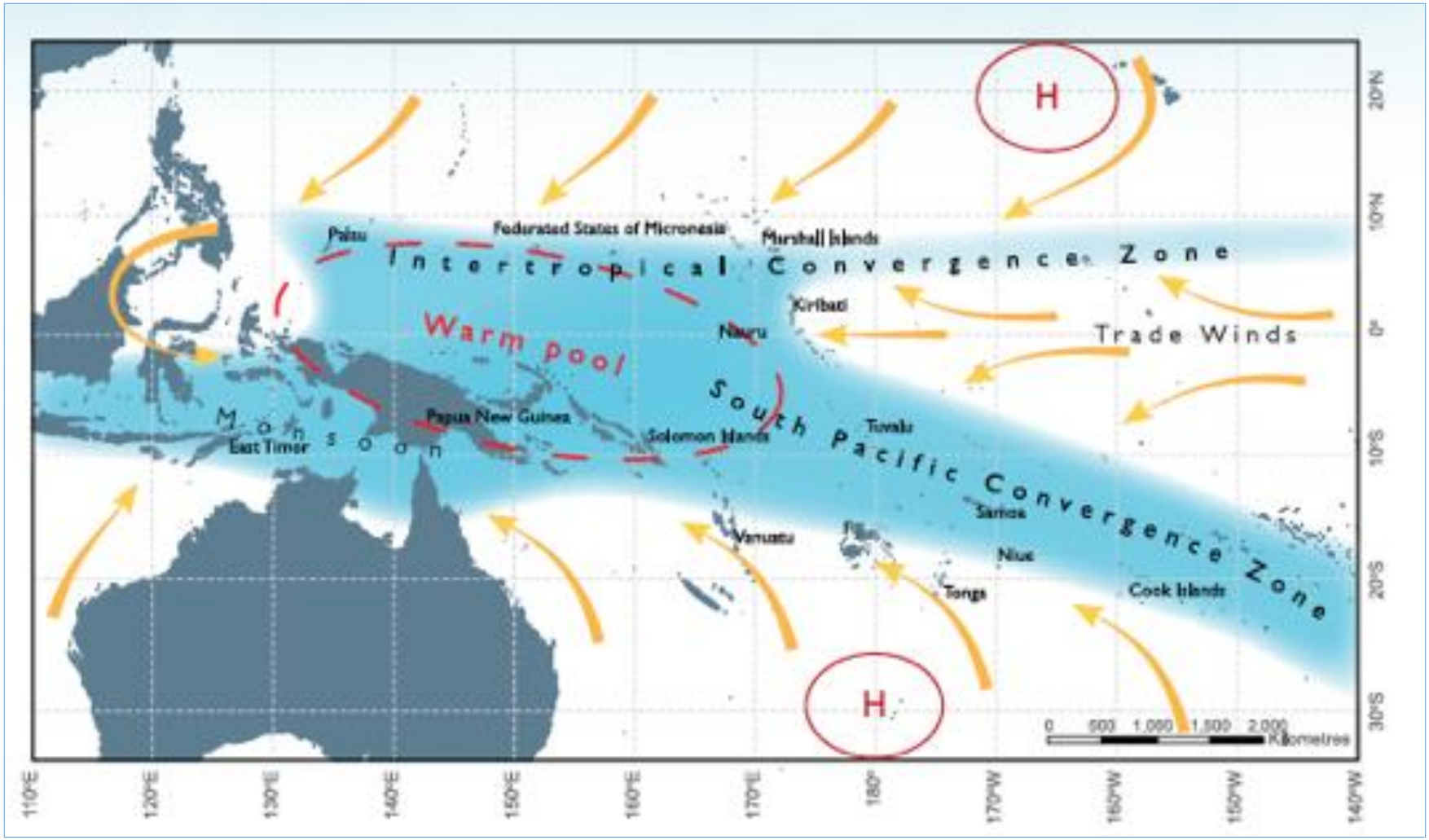


Figure 6-2. Average positions of the major climate features in November to April

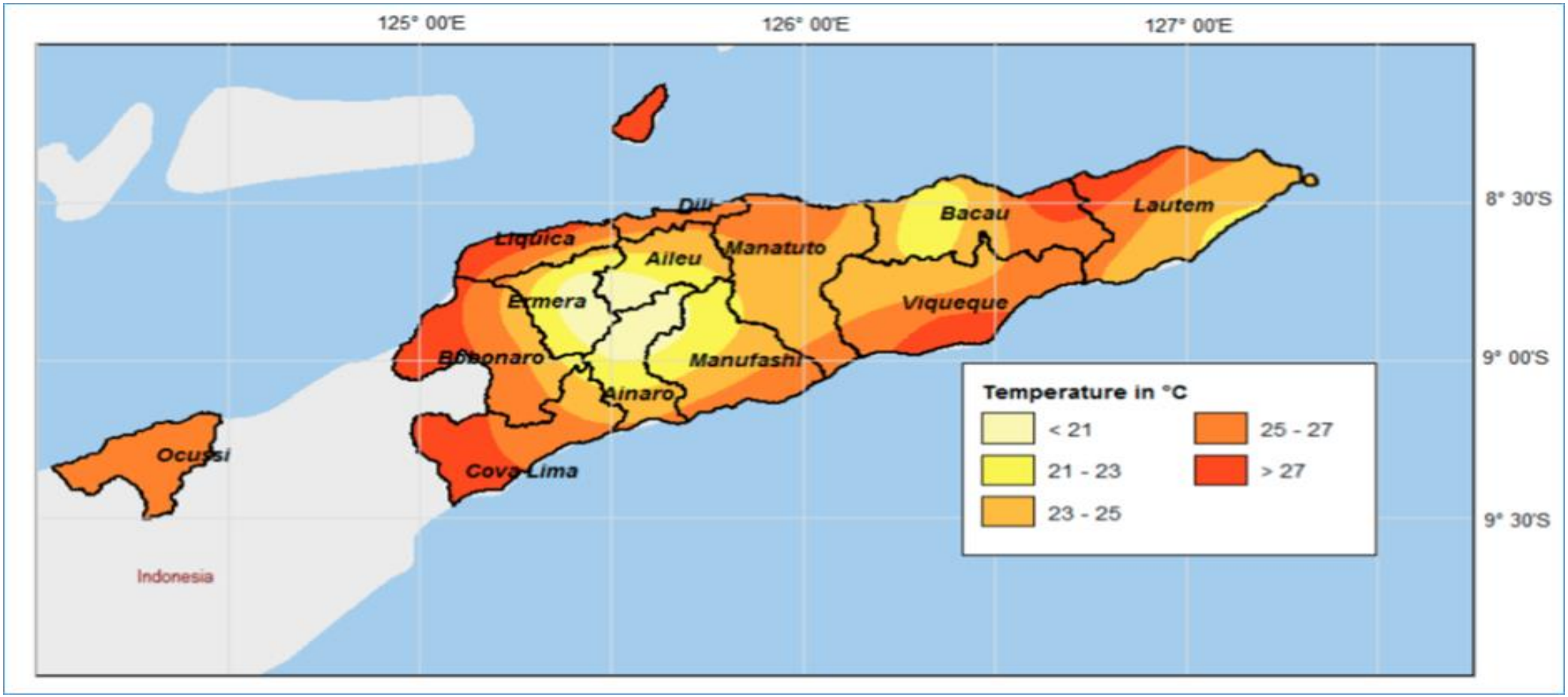


Figure 6-3. Annual Average Temperature of Timor-Leste (UNDP, 2013)

Temperature records from the Betano Refinery and Beaço LNG Plant Strategic EIS (Worley Parsons 2012a) are shown in Figure 6-4 and show typical temperatures between 25ºC and 35ºC. Temperature readings for the south coast area over an eight year period (after WorldClim, 2020) are presented in Figure 6-5 and Figure 6-6 similarly show the maximum temperature has been constantly between over 25ºC and below 35ºC; and the minimum temperature stays within the range of 20ºC to 25ºC. The figures further show temperature variations between wet season (normally from October, November and December) and dry season (usually occurs from June, July and August).

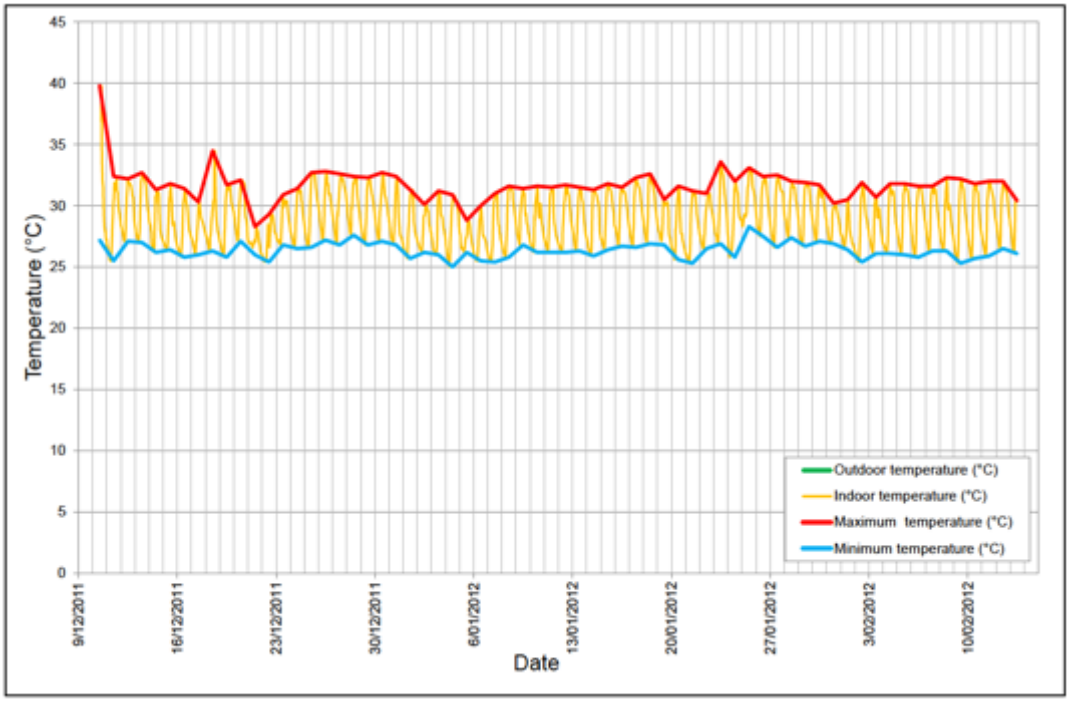


Figure 6-4. Temperature Records at Betano (after Worley Parsons 2012a)

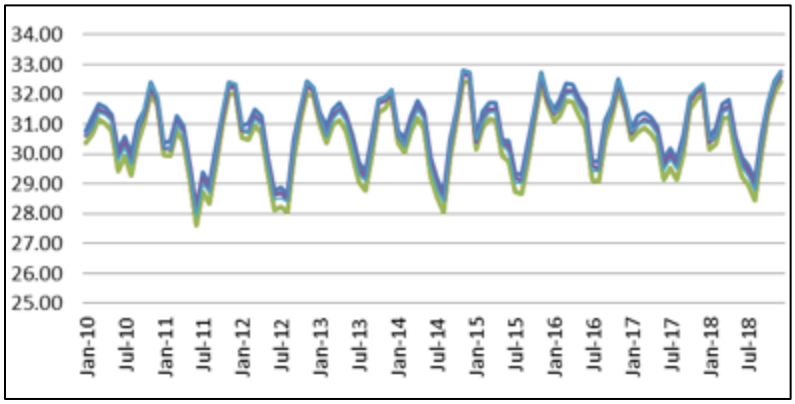


Figure 6-5. Maximum temperature recorded in the south coast area from 2010 – 2018
Source: (WorldClim, 2020)

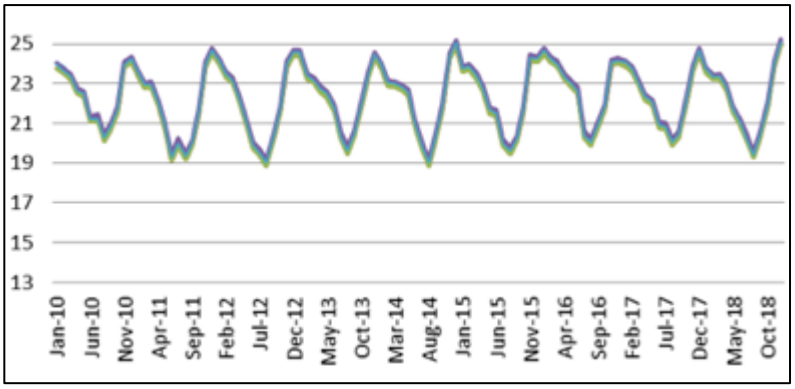


Figure 6-6. Minimum temperature reading in the south coast area for from 2010 – 2018
Source: (WorldClim, 2020)

These temperature data are also consistent with other secondary source data provided by the local National Directorate of Meteorology and Geophysics (DNMG) for the south coast region. The data is presented in Figure 6-7 below.

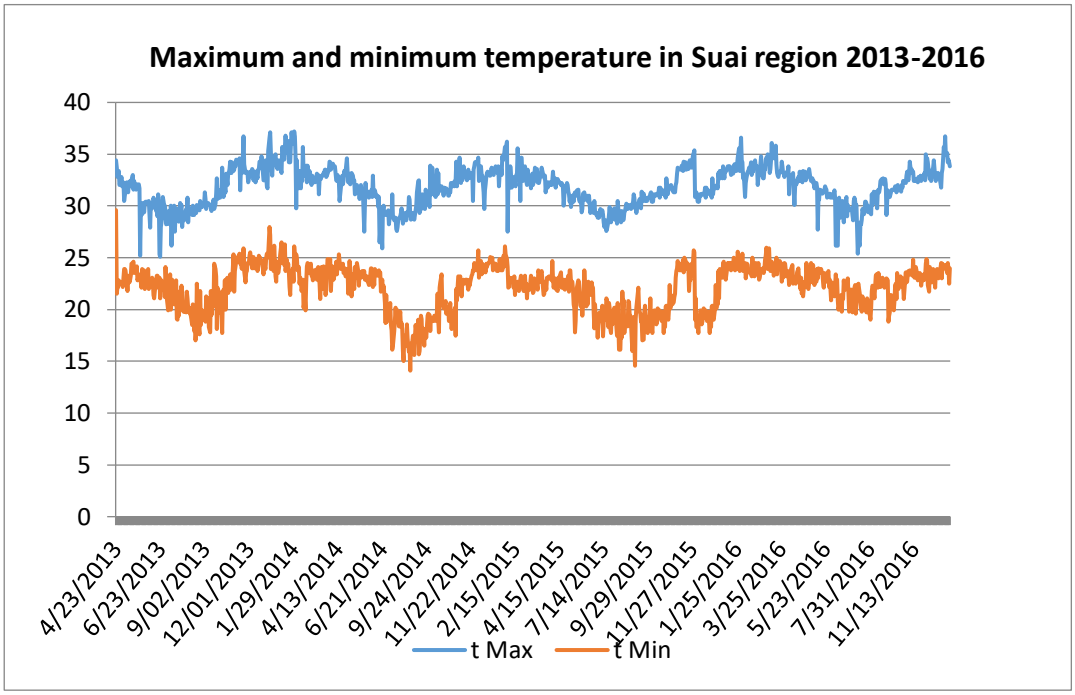


Figure 6-7. The maximum and minimum local temperature in Suai region from 2013 - 2016
Source: DNMG (data accessed on 2019)

The maximum and minimum temperature data given by the DNMG shows similar patterns over the four years recording period (from 2013 – 2016). Both maximum and minimum were low during the dry season and high during wet season. The maximum temperatures in the region are within the range of over 25ºC to less than 40ºC. Likewise, the minimum temperature also ranges from less than 15ºC to higher than 25ºC.

6.1.1.5 Relative Humidity

Relative humidity is one of several measures used to describe the amount of moisture in the atmosphere, and is the ratio of the actual amount of moisture in the atmosphere to the Maximum amount that could be held, at a given temperature.

The Betano EIA study (Worley Parsons, 2012a) states that the south coast of Timor-Leste is marginally more humid than the north coast and that with increasing altitude, humidity decreases. Betano was observed to have a marginally less humid climate than coastal regions to the southwest (Suai). Very little seasonal variation is evident from analysis of the Ministry of Agriculture data (2012). The maximum daily relative humidity is frequently above 90% throughout the year. The minimum daily relative humidity varies considerably more than the maximum and is on average in the range of 45% to 73%.

The daily profile (Figure 6-8) and the time series data (Figure 6-9) show that the measured indoor relative humidity varies less than the Ministry of Agriculture data (2012). The indoor humidity does not fall below 45% over the entire monitoring period and ranges up to approximately 85%. On average, the humidity would fall to a minimum slightly below 70% at 2:00 p.m. to 3:00 p.m. and then steadily climb to approximately 80% by 6:00 a.m. the following day.

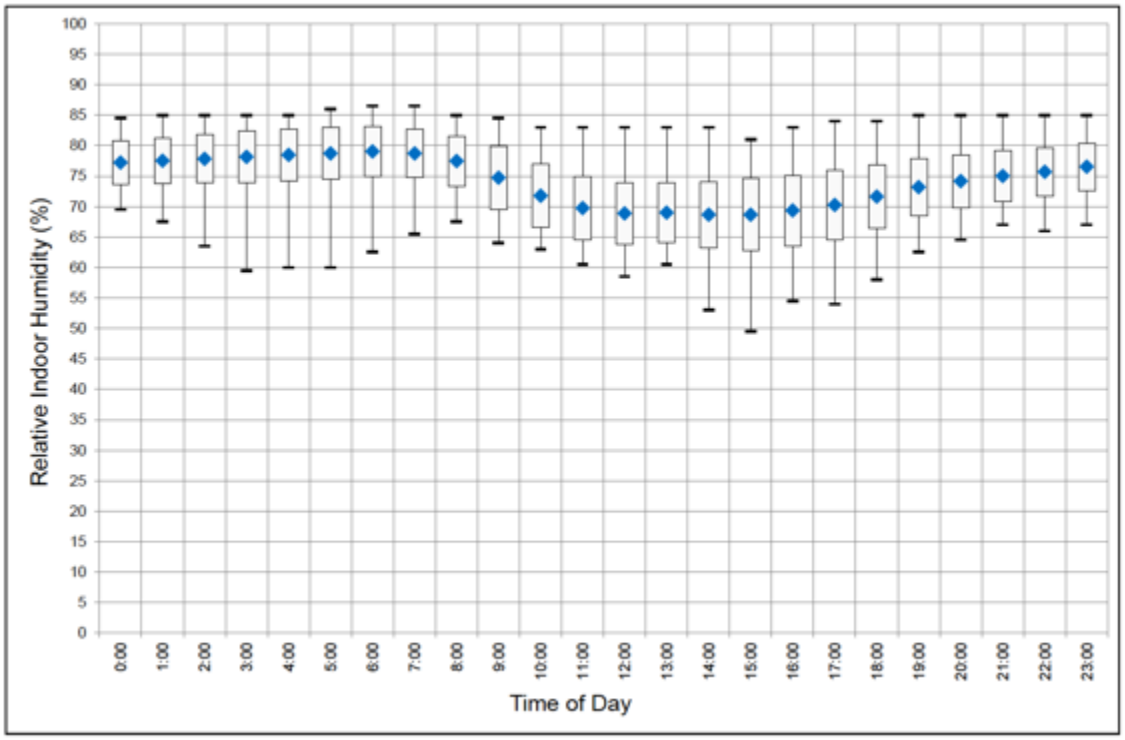


Figure 6-8. The Relative Humidity (%) Daily Profile at Betano
Source: WorleyParsons, 2012a

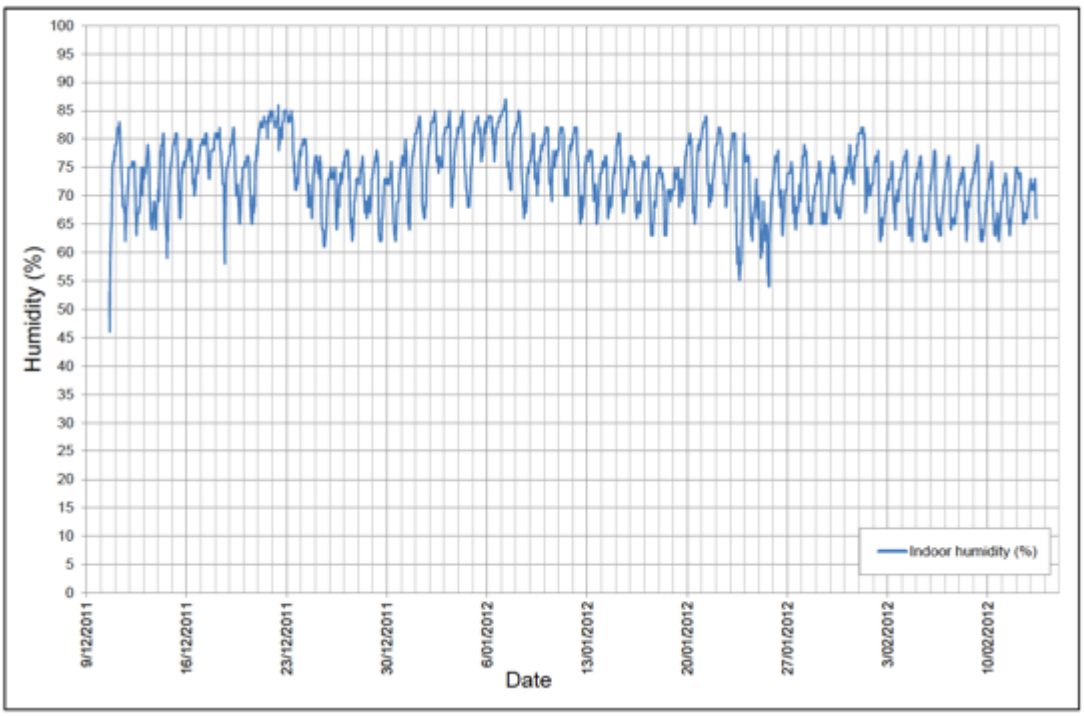


Figure 6-9. The Relative Humidity (%) Time Series at Betano
Source: Worley Parsons 2012a

The graphs shows that over the recording period from 2008 to 2014, the relative humidity has always been high at the Suai region, which always measured between less than 60% as the minimum, and reached up 100% for the maximum value. It further shows that the Relative Humidity reading pattern has been consistent or no changed throughout the recording period.

6.1.1.6 Wind Speed and Direction

A major factor that influences local wind speed and direction trends is the topography and land use of the region (Worley Parsons 2012a). The Betano development area and the surrounding coastal region is low-lying and has reasonably flat terrain with elevations at approximately 20 m and local peaks located around Nova Betano up to 250 m above sea level. Inland, approximately 10 km, the foothills begin with elevations approximately 400 to 500 m above sea level.

The wind rose for the Betano area is presented in Figure 6-10 represents data collected from the monitoring period only (December 2011 to February 2012). Due to the failure of the meteorological station, only 6% of the monitoring period produced valid wind speed and wind direction data. The wind rose shows that for the recorded data, a majority of the winds blew from the northwest at reasonably low speeds (less than 3.0 m/s). Currently, there is insufficient data to be able to determine prevailing wind patterns.

Figure 6-11 presents wind roses for the Dili airport, Baucau and the south coast study area (Suai, Betano and Beaço) after Worley Parsons Betano Refinery and Beaço LNG Plant Strategic EIS (2012a).

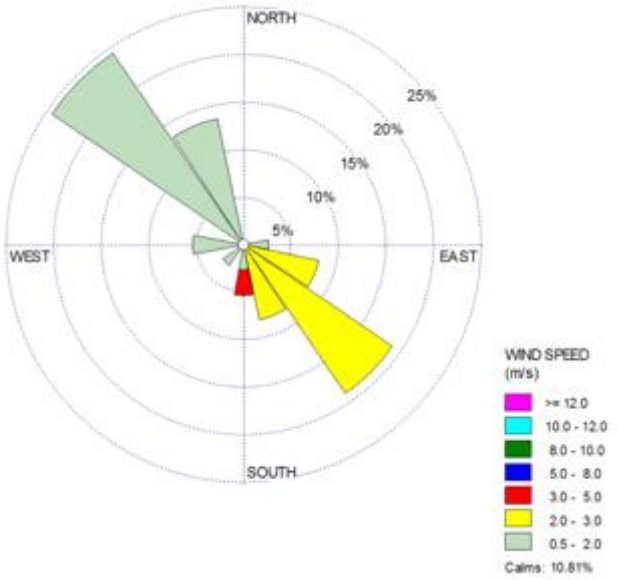


Figure 6-10. Wind speed and direction Betano region December 2011 to February 2012
Source: WorleyParsons, 2012a

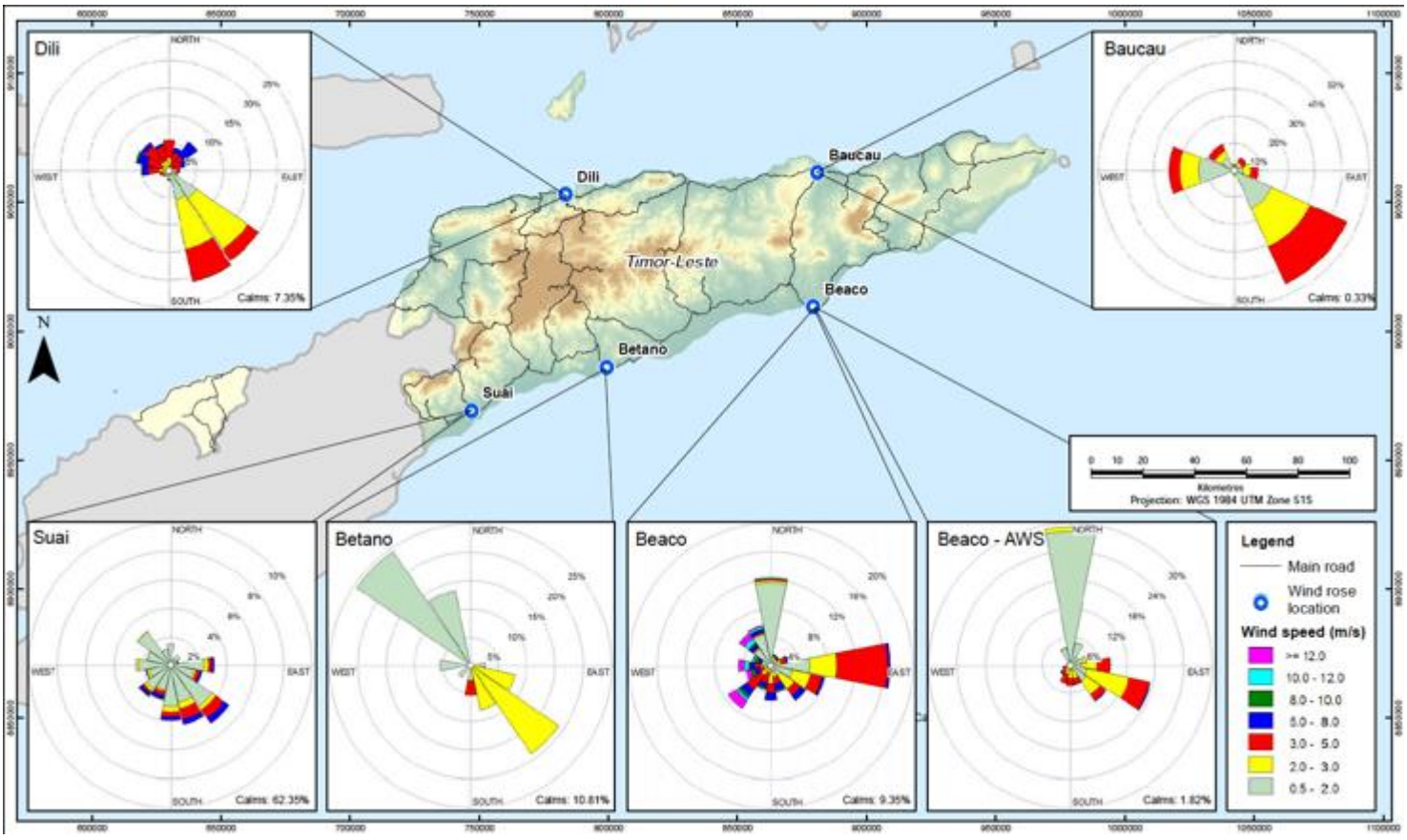


Figure 6-11. Wind speed and direction Suai region December 2011 to February 2012
Source: WorleyParsons, 2012a

6.1.1.7 Rainfall

In general Timor-Leste rainfall trends are influenced by the Asian monsoon, which has its rainfall distribution varied within the country. the northern side of the country experiences Northern mono-modal rainfall pattern, which has about 4-6 wet months start from the month of December to April or June; and the southern side rainfall influences by the Southern Bi-modal rainfall pattern, which has a rainfall for 7-9 months duration with two peaks within, one occurs at the month of December to January and the other one at the month of May to June (UNDP & GEF, 2013). Figure 6-12 below shows the rainfall distribution within the country. It indicates that northern side receives rainfall less than 1000mm per year; central and elevated area receives 1,500-2,000mm; and western with high elevation a receive relatively high rainfall of more than 2,500mm per year.

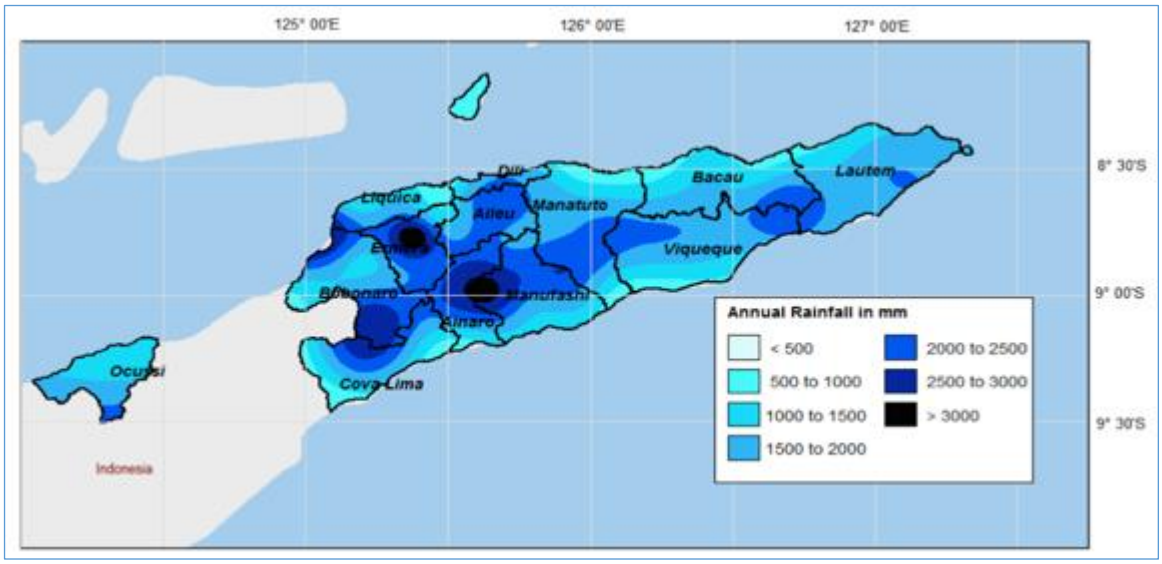


Figure 6-12. Timor-Leste annual rainfall distribution (UNDP, 2013)

Furthermore, in particular to Manufahi/Ainaro region, it can be seen that the central parts have high rainfall ranges from 2,500mm to >3000mm per year; and the southern region experiences rainfall of less than 500mm to 1000mm per year. The coastal areas clearly are dryer than those in the central areas with high altitude mountainous.

The rainfall analysis given by the UNDP (2013) is consistent with the Seed of Life (2013) rainfall data collected and analysed for the south coast region. Accordingly, it shows that Suai region has high rainfall period in the month of January – February, May – June and December annually. The rainfall recorded during these months are usually between 150mm and 250mm per year. See Figure 6-13 below for the rainfall level and period in recorded

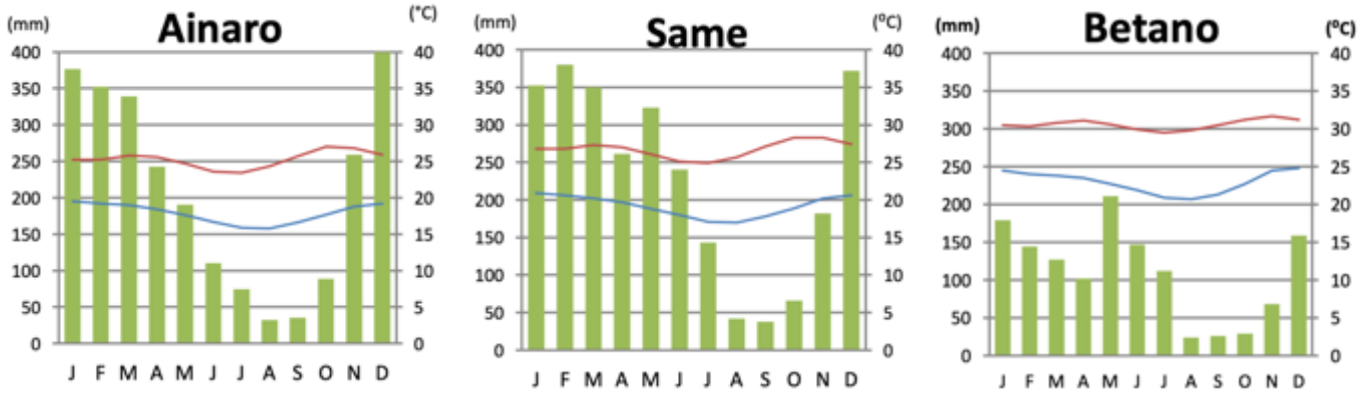


Figure 6-13. Annual rainfall level recorded in Ainaro, Same and Betano regions

Note: The red and blue lines are temperature measurement at the location, which is not part of rainfall analysis given to the intended region under this section.

The latest rainfall data collected for agro-climate by WFP in 2020 still consistent with both the UNDP (2013) and Seed of Life (2013) see Figure 6-14 rainfall data. Figure 6-15 below shows the rainfall data recorded for the month of February 2020 for all the municipalities within the country.

According to the WFP rainfall data recorded in February 2020, it shows that during that month most of the Municipalities, including Covalima (Suai) still experiencing high rainfall intensity above 120mm. This rainfall period however is lower in Dili, Manatuto and Bazartete (of Liquica Municipality), which have rainfall measured at less than 120mm.

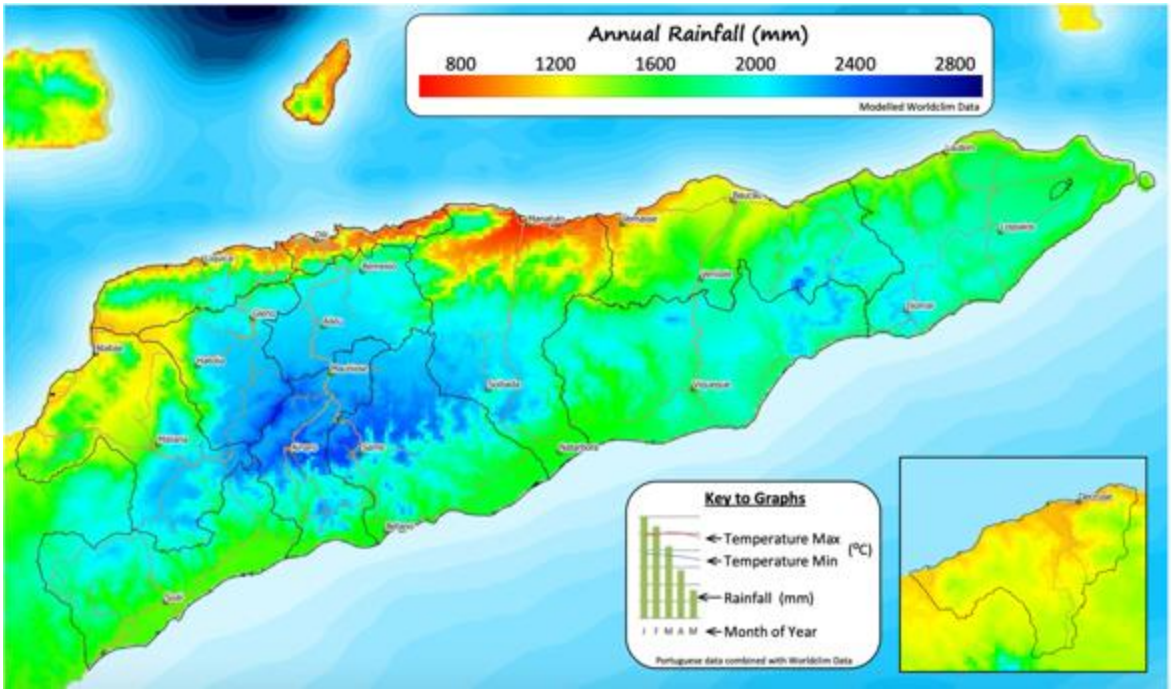


Figure 6-14. Annual Rainfall for Timor-Leste

(Source: Seed of Life 2013)

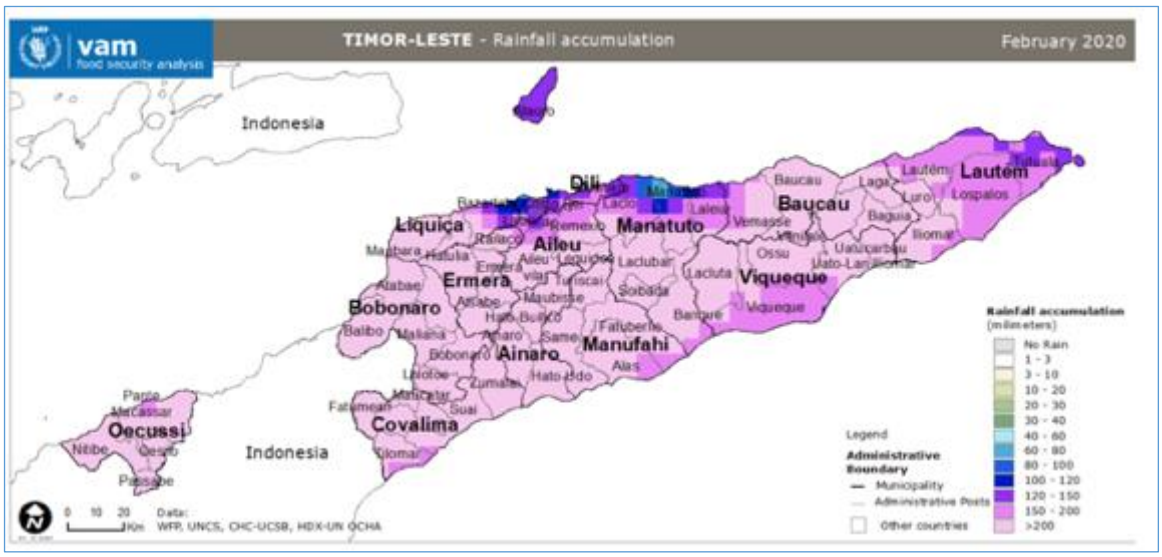


Figure 6-15. Rainfall accumulation for the month of February 2020 of Timor-Leste
(Source: WFP 2020)

6.1.1.8 Cyclones

Timor-Leste has tropical cyclone effects that usually occurs in the Timor Sea from November to April. Most of the tropical storms and cyclones originates or passes through the Timor Sea. These tropical cyclones are characterized by very strong winds and driving rain with high waves and storm surges. Accordingly, many studies shown that tropical cyclones activity at the Timor Sea is lower during El Niño period and higher during La Niña years (RDTL, 2010). This study of tropical cyclone is further recorded and analysed by the Australia Bureau of Meteorology Australian Tropical Cyclone database (*http://www.bom.gov.au/clim_data/IDCKMSTM0S.csv),* which shows the number of southern hemisphere tropical cyclones from year 1906 until 2018.

Within the mentioned period there are six tropical cyclones events recorded between the years 1983 and 2014 at 100 km radius passing through the Suai region and going towards the Timor Sea. The six tropical cyclones occurrence and direction can be seen in the Figure 6-16 below.

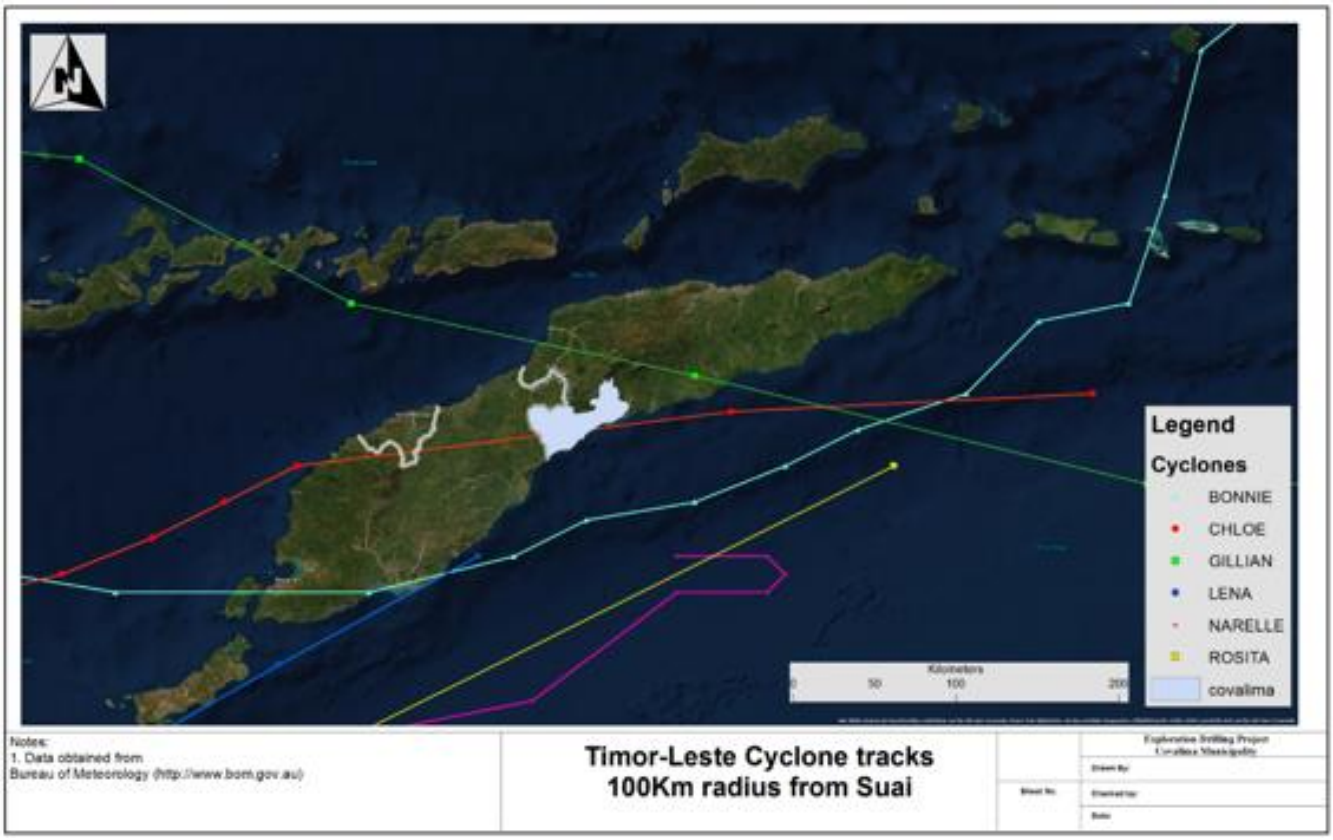


Figure 6-16. Tropical cyclones passing through to the Timor Sea recorded at 100 km from Betano

Further, Table 6-1 below shows the tropical cyclones' month of occurrence between 1983 and 2014; and the name of the tropical cyclones recorded at 100 km radius from the Betano region towards the Timor Sea.

Table 6-1. Tropical cyclones month of occurrence and names recorded at 100 km

Cyclone tracks 100 km radius from Suai	
Data Range	**Cyclone Name**
6 - 25 March 2014	Gillian
5 - 15 January 2013	Narelle
7 - 15 April 2002	Bonnie
14 - 20 April 2000	Rosita
3 - 8 April 1995	Chloe
2 - 9 April 1983	Lena

According to DNMG Country Report (DNMG, 2017) during the tropical cyclones of El Niño cycle, the country experiences less rainfall, short wet season (usually cause drought) and rainfall is concentrated on February – March; in contrast, the tropical cyclone of La Niña cycle causes the country to have more rainfall annually, longer wet season and more rainfall on dry season, which sometimes result in flooding and landslide.

6.1.2 Topography

About one third of Timor–Leste's topography is mountainous with a range of heights from 100m to almost 3000 m above sea level (Figure 6-17). The central and eastern parts of Timor-Leste contain several low plateaus and coastal lowlands fringed by the narrow coastal plain in the north and a wide coastal plain in the south.

The geography of Timor exhibits four significant mountain ranges: limestone mountain mount Matebean at a height of 2100 m above sea level dominating the east part of the island and including Lospalos, Baucau and Viqueque. In the central region the limestone mount Cablac and volcanic mount Ramelau cover most of the area, and the western part of the island is controlled by Mt. Taroman.

Deep Valleys, plateaus and low relief mountains are formed within the mountains. Generally, the slope of the north coast of the country is very steep toward the sea, on the southern side the slope from the mountains is a gradual decrease toward the sea.

Significant topographic features around the project area are shown in in Figure 6-18 and include:

- Mt Cablac coupled with low to high grade Lolotoi metamorphic controls the north to north east morphology.
- A coral limestone platform covers most of the western part of the project area with average height 300 m above sea level.
- The North east and eastern parts are dominated by Mt Bian and Mt Manumera and extend to Mt Kaitaba and Mt Cnuamotukleten.
- Mt. Akadirukau with a height 160 m above sea level occurs to the south of the project area with an alluvial plain extending towards the sea.
- In the far north west the landscape is controlled by recent deposition of the Batu Putih chalk that is expressed in a low relief to moderate morphology with an average height 120 m above sea level.

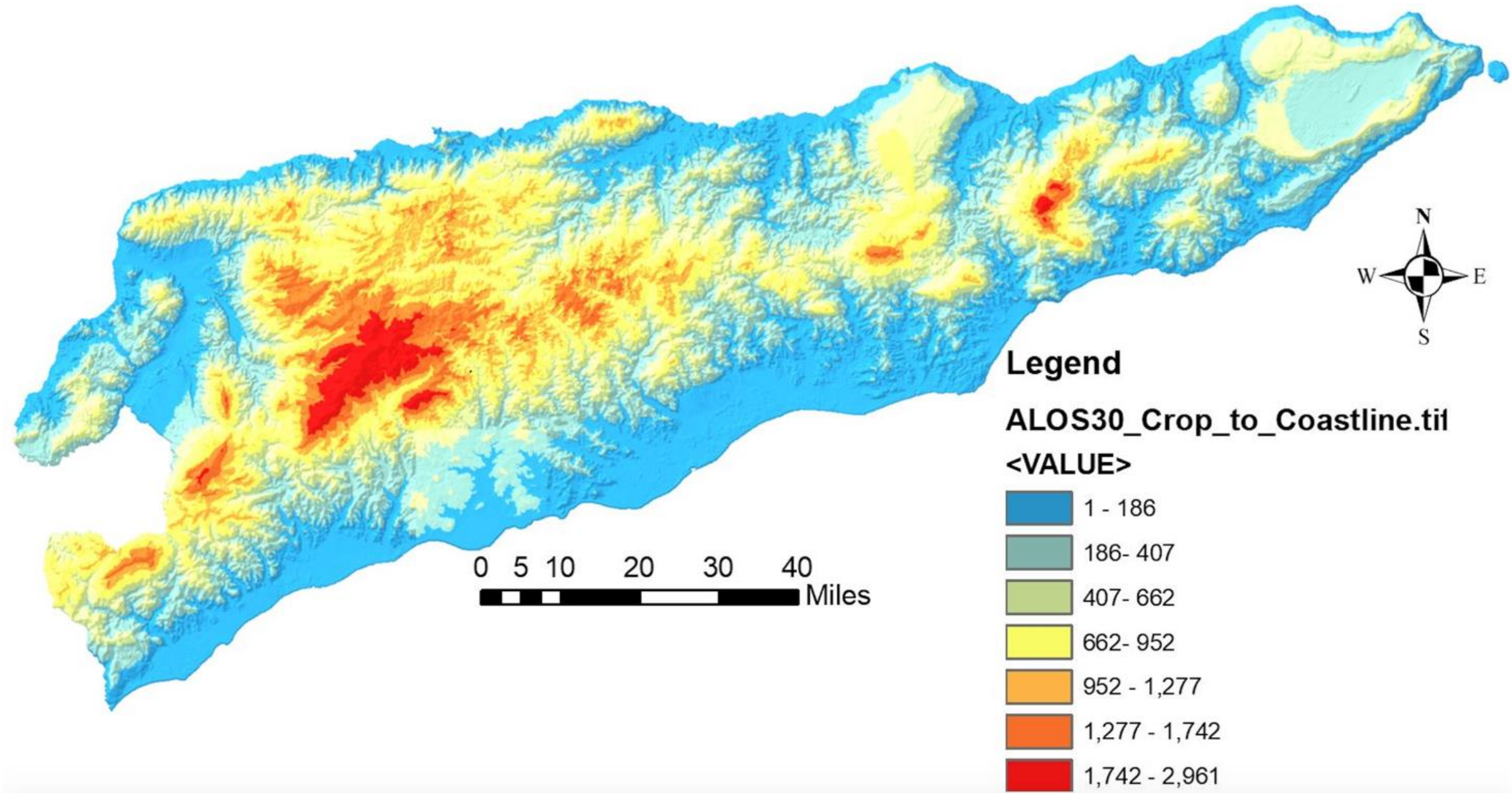


Figure 6-17. Topography of Timor (SRTM, 2020)

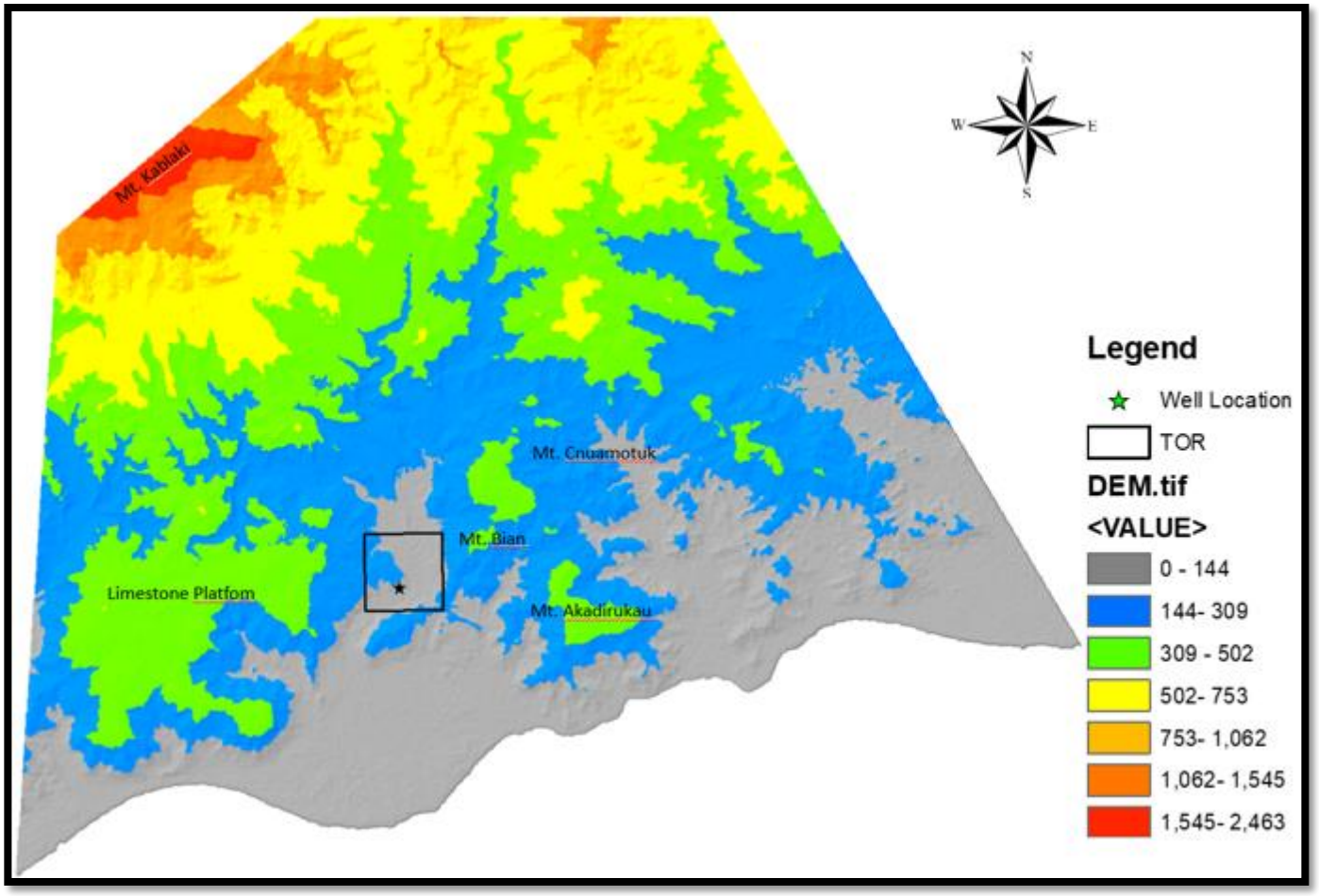


Figure 6-18. Topographic map of the project area.
Red box is the perimeter of the project area and star dot is indication of well locations.

6.1.3 Geology

6.1.3.1 General Geological Overview

The chaotic and highly deformed Permian – Triassic, Jurassic and Cretaceous rocks lead to dispute of Timor tectonic history. Several hypotheses have been introduced by various geological researchers to describe tectonic and rock formation history (Audley-Charles 1968, Hamilton 1979, Harris 2006, Keep and Haig 2010), however these theories are all consistent that onshore Timor is composed of rocks from the Gondwana Megasequence, Australian Megasequence and Banda Terrane affinity.

Rocks in Timor-Leste range in age from Late Carboniferous to recent. The following are the main tectono-stratigraphic units that are recognised in Timor-Leste:

1. Gondwana Megasequence: Latest Carboniferous to Middle Jurassic succession. This sequence is represented by carbonates, siliciclastics and Permian volcanics that were deposited within the interior of the East Gondwana rift system (Harris et al 1998, Harris 2006, Haig and McCartain 2007 & 2010, Davydov et al 2014).

2. Australian Margin Megasequence: Late Jurassic to Early Late Miocene units dominated by pelagic calcilutite and subordinate radiolarian rich accumulations in middle bathyal water depths during the Early Cretaceous on the Australian passive margin (Haig and McCartain 2007).
3. Indian Ocean deposits: Middle – Late Jurassic. Dominated by siliceous argillites and radiolarites (Haig and Bandini 2013)).
4. Banda Terrane: Late Cretaceous to Early Miocene. Asiatic units, shallow water and upper bathyal strata, metamorphic units, and other sedimentary strata. Emplaced during collision (Audley-Charles & Harris 1990, Harris 2006, Haig et al 2008). Alternatively, the metamorphic units have been attributed to the Australian Continental Margin basement (Grady 1975, Grady & Berry 1977, Chamalaun & Grady 1978, Charlton 2001 & 2002)
5. Synorogenic Megasequence: Latest Miocene- Pleistocene to recent (Haig & McCartain 2007; Roosmawati & Harris 2009). Shallowing – coarsening up succession composed of deep-water chalk/marls passing through turbidites sands to marginal marine, then fluvial deposits.

From these tectonostratigraphic units, combine with field observation and palynology analysis Timor Resources has simplified a stratigraphic column that adapted from Duffy 2017 (Figure 6-19).

6.1.3.2 Geology PSC TL-OT-17-09

Rock distribution in PSC TL-OT-17-09 shows most of the oldest rocks from Permian to Triassic are well represented in the north and south west of the area. Mount Cablac is covered by Triassic Perdido Group and interpreted to be thrusted over Lolotoi Complex. South east and south west of Mt. Cablac is covered by syn-orogenic deposition of Batu Putih and Viqueque Group. Permo-Triassic units commonly topped by Baucau limestone are well exposed between the Belulik River (Cassa Bridge) and Caraulun river near Same. A late Cretaceous unit of Wai Bua Formation is cropping out in central Betano and its surrounding area.

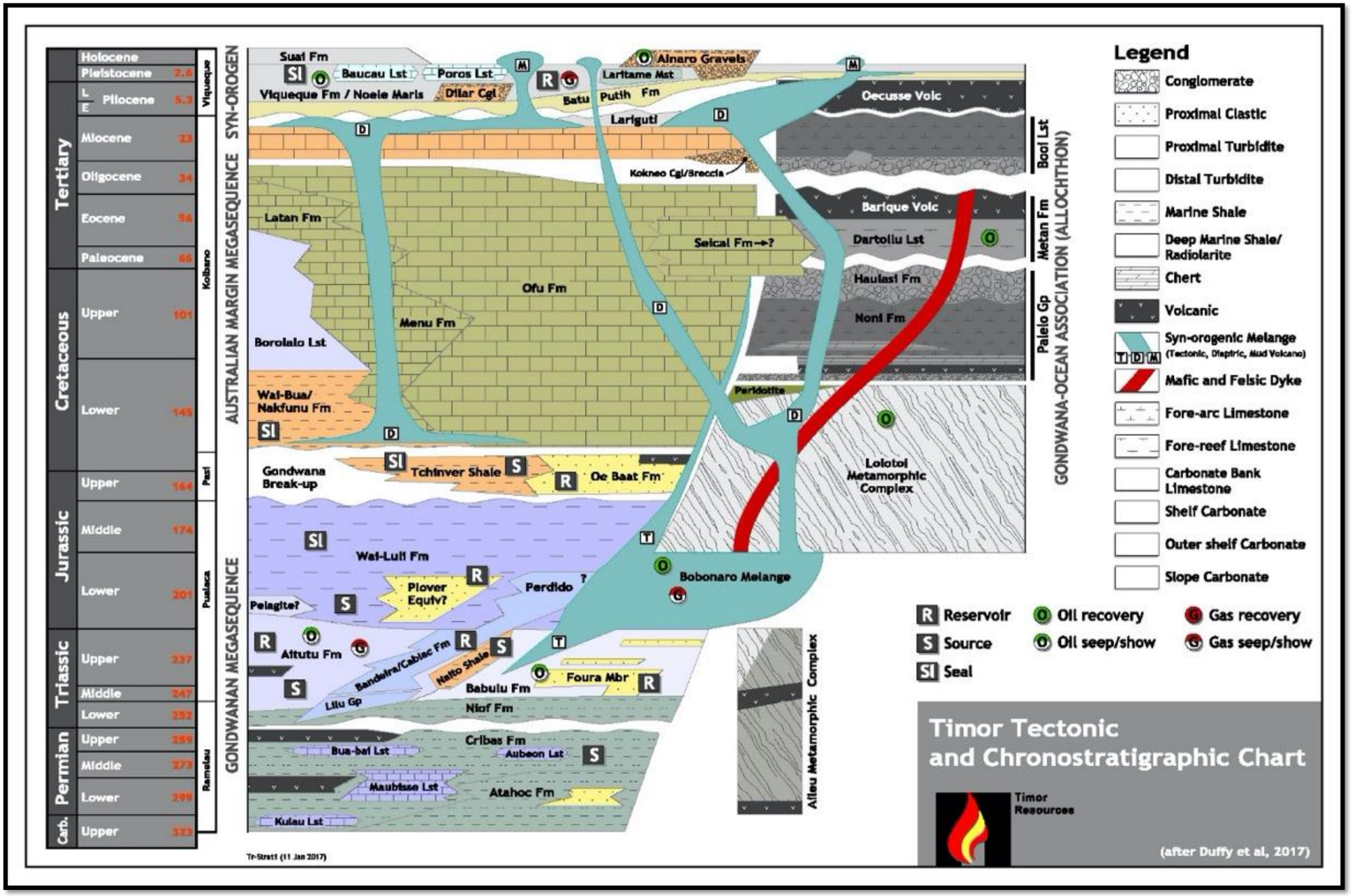


Figure 6-19. Tectono-chronostratigraphic column of Timor

At the location of Rusa-1, are rock units that range from Permian to recent. The following is the physical description of all the rock units that occur in the vicinity of the wellsite in order from oldest to youngest.

6.1.3.2.1 Maubisse Formation

This Formation is named after large cliffs of thick bedded red limestone associated with volcanics to the south west of Maubisse village. The limestone comprises abundant Crinoid stems, Bryozoa, Brachiopods, Ostracods, Tubiphytes (Audley-Charles 1968 and Haig 2014). This Formation is predominantly a carbonate succession with minor volcaniclastics which occur together in some outcrops.

At the type locality Maunlai ridge it is estimated to be 180m thick (Haig et al 2014). Massive to thick-bedded bioclastic limestone, mainly packstone, were described at the Maunlai ridge. From microfacies analysis (Nogami 1963, Audley-Charles 1968 and Haig 2017) the Maubisse section is assigned as Late Permian Guadalupian. Presence of crinoidal, brachiopod packstone indicate Permian shallow carbonate-mound-platform deposits.

The Maubisse outcrop in the area of the Rusa prospect location covers approximately two square kilometres in the west and north west. From field observations near the proposed well site, this formation is composed of massive, red and sometime orange limestone, commonly occurring as blocks and boulders. It is very indurated and rich with Crinoid stems, and from acetate peels analysis it contains at least three type of Bryozoans (fenestrate, cryptostominid and trepstone). Brachiopods and Fusulinids are also found in samples in other locations (Figure 6-20).

Figure 6-20. abundance of Maubessi limestone in Rusa-1 wellsite vicinity.
Blocks of Crinoid limestone. Inset photo showing bryozoan from acetate peel analysis (A) . Close up view of crinoid limestone with bivalve (B).

Permian volcanics are associated with the limestones, in this locality they commonly occur close to red limestone. They are exposed as highly weathered volcanic basalt, sometimes as pillow lava and occasionally as volcanic breccia (Figure 6-21).

Figure 6-21. Highly weathered Permian volcanic block

Stratigraphically the Maubisse Formation is overlain by the Triassic Aitutu and Babulu Formations though the contact is rarely seen in the field.

6.1.3.2.2 Babulu Formation

The Babulu Formation was first mapped in West Timor by Gianni 1971 at Babulu river. This Formation is composed mainly of shales, that alternate with sandstone and siltstone layers. Shales are usually black or dark grey, occasionally micaceous, and bituminous and sometimes laminated. In Timor-Leste, this Formation was mapped by Monteiro in 2005 in the Manatuto area where organic rich fine-very fine-grained sandstone is categorised as both potential reservoir and source rock.

The Babulu Formation was mapped as a member of Wailuli and the flysch types were mapped as Aitutu Formation by Audley-Charles 1968. Monteiro 2003 described two members of Babulu Formation in Timor:

1. Shales; are usually black to dark grey, sometimes micaceous, bituminous. The thickness ranges from laminae – several meters thick, sometimes chaotic, and some shales contain *Halobia.*
2. Thick bedded sandstone: the bed thickness ranges from (1-7m) sandstone interbedded with paper thin shale. Occasionally exotic limestone beds occur within the sandstone succession.

At the Rusa-1 proposed well location the Babulu Formation is well exposed to the south east around the Betano irrigation area. It is predominantly green-grey, medium-fine-very fine grained sandstone, which is, from visual examination it appears to be porous and permeable. Bed thickness range from 2 cm – 1m thick, it contains burrowing structures (chondrites) in sandstone and is interbedded with paper thin grey shale. It is commonly highly deformed with very steep dips, well sorted, overall fining-up/thinning-up sandy succession overlying grey silty shales. Most of the riverbank cuttings contain metre-decimetre beds. The sandstones are rich in carbonaceous fragments and have clay chips which possibly indicate the base amalgamated bed (Figure 6-22).

Figure 6-22. (A) Very indurated fine-grained sandstone overlying by grey thin shale layers. (B) Very thick bedded sandstone cropping out in the middle of the river
(Insert photo A showing close up of clay chips tracks in sandstone.. Insert photo B is closeup of thick beds.)

The Babulu Formation is one of the Gondwana Megasequence units that is well distributed at surface in the onshore. From palynology the Formation is assigned as Ladinian – Carnian (Middle – Late Triassic) in age, it is overlain by the Jurassic Wailuli Formation.

6.1.3.2.3 Bobonaro Formation

Stratigraphically Audley Charles (1968) divided the Bobonaro Melange into two principal units; scaly clay matrix and the exotic material. Ron Harris (1998) added one more unit called Broken Formation. Most of the melange fragments are derived from the older known rock units. The qualitative field criteria for Classification of Bobonaro melange is shown in Table 6-2 .

In more recent research the Bobonaro Melange is genetically classified into three categories; diapiric melange, tectonic melange and broken formation based on internal structure and relationship with nearby rocks.

The name of Bobonaro melange is derived from the Bobonaro scaly clay that is well exposed beside the Loumea river in east of Bobonaro village where the outcrop is almost 8 km long.

Table 6-2. qualitative field criteria for Classification of Bobonaro melange

Classification	Matrix rich	Mixed Block in clay	Broken Formation
Range of block type	Narrow - wide	Very wide (most units)	Narrow (1-2 formations)
Most common source	Australian affinity units	Mixed both Australian and Asian affinity	Australian affinity units
Block size	Mostly granular and blocks <1m	Typical bimodal >m Maubisse Formation and Banda Terrane	Mostly <10m
Matrix characteristic	Well-developed flow and scaly fabrics	Well-developed flow and scaly fabrics	Well-developed flow and scaly fabrics
Matrix to block	>5:1	1:2 to 5:1	1:3 to 3:1
Contact relations	Both cross cutting and concordant intrusive	Locally transitional with broken Formation, cross cutting and fault related.	Varies but transitional with nearby units
Bedding	Absent	Mostly absent	Mostly retained
Structural correlation and distribution	Diapirism and mud volcanism throughout orogenic wedge	Surrounding high-level nappes of Maubisse Formation and Banda Terrane	Close to decollement and in diapirs of southwest Timor

At the proposed well location, the Bobonaro melange occupies most of the western part with some contact with Maubisse Formation. In the Rusa-1 area the Bobonaro grey, and rarely red, clay, mostly muddy, with fragments of other lithologies such as Lolotoi Complex, Perdido Limestone, Babulu Sandstone and blocks of Maubisse Formation (Figure 6-23). From field observations the melange near the Rusa-1 well site is categorized as tectonic melange.

Figure 6-23. (A) Exotic blocks of limestone within mud. (B) Sandstone block of Babulu within mudstone.

Stratigraphically the Bobonaro was first dated as the youngest syn-collisional melange of Miocene age by Audley-Charles (1968), however in recent studies Benincasa 2009 assigned it

as Triassic in age based on well preserved palynomorphs, rare acritarches and nodsariid foraminifera.

6.1.3.2.4 Wai Bua Formation

Wai Bua Formation is an autochthonous unit that is well exposed in the Betano area particularly well cropping out along the Caraulun river. This Formation is characterised by a well bedded radiolarian succession, white and sometimes pink in colour, predominantly calcilutite and occasionally calcarenite, frequently manganese occurs as nodules, as do bright coloured cherty radiolarite.

Audley-Charles (1968) defined the type locality of this Formation in an area of poor outcrop about 5 km north east Betano. Photogeological and field observation suggested a thickness of at least 500 m. Presence of fossil fauna and very fine grained pelagite carbonate with radiolarian shale are indications that this sediment accumulated in open marine and deep sea.

At the proposed Rusa-1 well site, this Formation is well exposed to the east and north east of the well location. It is well exposed along the downstream extent of the Sui river and outcrops in the eastern part of Riatu village. It is very light pink in colour, highly fractured, occasionally faulted and at least 18m thick. Sometimes it is exposed as massive and chaotic and locally well bedded successions with no shale in the lower part of outcrops (Figure 6-24 and Figure 6-25).

Figure 6-24. Well bedded radiolarian succession with chert as nodules.
Exposed in the north of Rusa-1 well location.

Figure 6-25. Highly fractured carbonate pelagite at Caraulun river west of Sesurai Village.
(GPS Coordinate Latitude: -9.112094° and Longitude: 125.690177°)

Audley-Charles (1968) assigned the Wai-Bua as Campanian – Maastrichtian or Late Cretaceous based on radiolarian identification.

6.1.3.2.5 Batu Putih

The oldest synorogenic deposit was mapped as part of Viqueque Formation by Audley-Charles (1968) in his reconnaissance report. He defined it as the lower part of the Viqueque Group and was comprised of a series of distinctive white calcilutites and tuffs with subordinate marls. Planktonic foraminifera are the dominant fossils, particularly with abundant *Globigerina*. Benthonic forams occur as accessories as well as molluscs, ostracods, fish debris and pyritized organic matter.

The Batu Putih as a separate Formation was firstly introduced by Kenyon (1974) in West Timor, as the oldest lithology in the syn-orogenic deposit of the central Basin Succession. In onshore Timor-Leste, Haig and McCartain (2007) reported the carbonate chalk as the lower section of Viqueque Formation. In the PSC TL-OT-17-09 permit area, the Batu Putih is well distributed in the eastern part of block, from the Dotik area and extending to the northern contact with the Lolotoi complex. The Formation is also well exposed along the road between Same and Daisua (Figure 6-26) .

From field observation this Formation is characterised by white, chalky, friable, mostly massive but occasionally bedded, with woody material. In some areas the Batu Putih is conformably overlain by younger Formations.

A sample of pale argillite with abundant of planktonic foraminifera examined by Timor Resources contains Globorotalia Tumida, Sphaeroidellopsis kochi, Globorotalia limbate and Globorotalia tumida. Based on these fossils Batu Putih is assigned as (N18-N19) or early Pliocene. Haig's (2012) examination of planktonic foraminifera recognises it as Early Pliocene deposition in the syn-orogenic Megasequence.

Figure 6-26. Broken, massive Batu Putih. well exposed on the roadside between Same and Daisua.

6.1.3.2.6 Baucau Formation

The Formation is characterized by karst morphology and a dark red soil. It is a hard, vuggy, cavernous, massive white coral reef limestone. Four lithologies were described by Audley-Charles (1968):

1. Coral reef limestone. These are massive, dense, in situ growths of coral with subordinate amounts of calcareous algae.
2. Calcirudite. Massive - poorly bedded conglomerates, composed of reef debris cemented by micrite and sparry calcite from lenticels within situ coral limestone.
3. Calcarenites. Interbedded with in situ reefs, almost entirely composed of sand grains, coral fragments, bryozoans, foraminifera and calcareous algae with minor molluscs and echinoderms.
4. Sub-mature greywacke - pebble sandstone.

The Bacau Formation is named after the series of terraced reefs outcropping around the Baucau town. In the Baucau town area it forms karst morphology. Good exposures of this formation occur at Fatumean Suai, and at the top of Mt. Laritame, 1300 m above present sea level (Gilsel 2010).

Generally, in PSC TL-OT-17-09, good exposures occur in the Hatu-Udo (Figure 6-27), Betano and Dotik areas. In the Hatu-Udo area the Baucau limestone lies conformably on Viqueque Formation. From the presence of coral-algal-foram limestone in the Formation it is assigned as Early Pleistocene (Audley-Charles 1968 and Borges, 2010).

Figure 6-27. Contact between Baucau limestone and Viqueque Sandstone. Hatu-Udo.

6.1.3.2.7 Ainaro Gravel

The type section of Ainaro Gravel is based on exposed terrace deposits at 800 m above sea level in Ainaro village. In the Ainaro river the terraces have been left behind by the present river that has cut a gorge more than 40m deep. Similar outcrops are found in Laclubar, Cribas, Same, Aileu and Railaco on the present riverbanks.

The Ainaro Formation comprises of boulders, pebbles and gravel, sand, and silt, all are lenticular and strongly cross-bedded. Generally, this formation is friable, but locally it is calcite cemented.

At the proposed well location particularly Rusa-1 well, the Ainaro Formation is cropping out to the north of well location (Figure 6-28). It is characterised by boulders, pebbles, and gravel of older lithologies such as fragments of Lolotoi complex, boulders of Triassic units and sand.

Figure 6-28. Good exposure of Ainaro gravel to the north well of Rusa-1 Well location.

6.1.3.2.8 Alluvial Deposits

Quaternary alluvium is well deposited along the coast and riverbanks. These sediments are transported and deposited by rivers in last few thousand years. Alluvial sediments overlie the native bedrock and often form rich soils. These deposits are characterised by clay and silt mixed with fragments and boulders of other lithologies.

Generally, in PSC TL-OT-17-09 the river deposits are well distributed in the Same area, even at high altitudes. In the Rusa-1 well location they occur to the east and south west (Figure 6-29).

Figure 6-29. Loose, sand, clay and silt with fragments of other lithologies overlie Triassic Babulu sandstone.
(Photo taken in southwest of Betano irrigation (Rusa-1 area))

6.1.3.3 Petroleum System

Occurrences of a large number of oil and gas seeps in onshore Timor-Leste indicate an active petroleum system. Elements of the petroleum system onshore have been identified by various researchers such as: (Audley-Charles,1968), (Charlton,2002), (Monteiro,2003), (Ferreira, 2011), (Timor Resources, 2017). Source rocks range from Triassic Aitutu Formation and Babulu shale– Jurassic Wailuli shale. From field observation Babulu Sandstone, Aitutu Fractured limestone, Jurassic Wailuli sandstone, and Viqueque Formation are categorized as potential reservoirs. Shale of Viqueque and Wailuli are potential seals. The stratigraphy column (Figure 6-19) denotes Source as "S", reservoir as "R" and seal as "Sl". There has been little study of migration pathways, due to lack of sub-surface definition by seismic. The Main objective of this exploratory drilling is to test two type of plays within the area of PSC TL-OT-17-09:

- A primary Jurassic-Triassic Marker target and secondary intra-Triassic targets interpreted as either being more proximal clastic equivalents of Babulu and Wai Luli clastics and carbonates.
- A deeper Sub-Decollement target which possibly represents underplated Australian continental clastic and carbonate units (optional deeper target only).

6.1.4 Air and Noise

Clean air is considered to be a basic requirement of human health and wellbeing, however, air pollution continues to pose a significant threat to health worldwide according to the World Health Organisation (WHO, 2005). This section reviews the air quality in the drilling area as a baseline against which any potential impacts associated with the PSC No.: TL-OT-17-09 drilling project can be assessed.

6.1.4.1 Sensitive Receptors

The locations of sensitive receptors relative to the drilling area were identified from aerial photography, on-site visual inspection during the Terms of Reference surveillance visits and in a desktop assessment of the local area. Based on the assessment, the sensitive receptors identified for collection of air quality and noise measurements are shown in Table 6-3 and shown in Figure 6-30.

Table 6-3. Sensitive Receptors for Air Quality Noise and Water Sampling

Well Site	Location	Sensitive Receptor	Distance (km)	Centroid Coordinates	
				Latitude	Longitude
Rusa-1	Aldeia Sessurai	School area	1.06	09º 06'31.1" S	125º 41'44.8" E
	Aldeia Fatukabelak	Resident Settlement	0.93	09º 07' 05" S	125º 41' 33.8 "E
	Aldeia Raimerlau	Resident Settlement	0.47	09º 06 '52.5" S	125º 41" 00" E

6.1.4.2 Air Quality

The study method adopted for this assessment is as follows:

- Identify and present available secondary data sources.
- Identify air quality sensitive receptors (i.e., residences, schools) in the study area (see Table 6-3).
- Collect baseline primary ambient air data in the study area. This was completed in February 2021.
- Air Quality and noise data was collected and analysed by identified and experienced local laboratory in accordance with internationally recognised standard, using calibrated hand held instruments as follows using hand held instruments as follows:
  - Particle Counter AMT18 and HTI HT-9600 measuring during 24 hour nonstop.
  - Gas Analyzer Model/type BH-4S to knows the O_2, H_2S measuring 2 times for one day (morning and afternoon).
  - Gas Detector Model/type BH-90A to knows the parameter of NO_2, SO_2 and O_3 measuring 2 time for one day (morning and afternoon).
  - Anemometer Model/type Benetech GM 8901
- Assess the baseline ambient concentrations of particulates and gas pollutants against the assessment criteria.
- Calculate levels of gaseous emissions from diesel generators, plant and vehicles during the project See Section 9.3.3
- Examine management measures to minimise air emissions See Section 9.3.3.
- All the data were compared with international guidance published by International Finance Corporation (IFC, 2007a) and the World Health Organisation (WHO, 2005).

Study Scope

The scope of this study incorporates the drilling project area as described in Chapter 4. The project has the potential to produce the air emissions during facility and road construction mainly related to dust and from equipment burning diesel as identified in Table 6-4. Emissions will be calculated using accepted industry guidelines related to diesel generators and engines (see Section 9.3.3).

Table 6-4. Emission Sources during exploration Drilling

Emission source	Purpose	Treatment	Point of Emission	Emission Gas
Diesel fuel	Engine for power production drilling rig, vehicles	Combustion	Engine exhaust	CO_2, NO_X, CH_4, CO, N_2O, Particulates
Well testing	Testing of wells	Combustion	Burner	CO_2, NO_X, CH_4, CO, N_2O, Particulates
Other direct hydrocarbon emission	Drilling fluid Well clean-up Fugitives and leakages Produced water Storage tanks	None None None None None	Evaporative Vent stack/tanks BOP Vent stack Vent stack	VOC, CH4 VOC, CH4 VOC, CH4 VOC, CH4 VOC, CH4
Dust	Construction activities	None	Ground level	Particulates

Figure 6-30. Rusa-1 Sensitive Receptors - Air Quality Noise and Water Sampling Locations

Secondary Data

The following secondary data sources were accessed:

- World Bank (2009). Timor-Leste: Country Environmental Analysis. Sustainable Development Department, West Asia & Pacific Region. July 2009.
- Japanese International Cooperation Agency (JICA) (2016). Timor-Leste: National Road No. 1 Upgrading Dili - Baucau. Simplified Environmental Impact Statement/Initial Environmental Examination. Project No.: 50211-001. August 2016.
- Worley Parsons Tasi Mane Project - Betano Petroleum Refinery and Beaço LNG Plant Strategic EIS. Final Report No. 301012-01504-EN-REP-0005. June 2012. (Worley Parsons, 2012a)
- Worley Parsons Tasi Mane Project - Suai Supply Base Environmental Impact Assessment. Final Report No. 301012-01504-EN-REP-0003. May 2012. (Worley Parsons, 2012b)
- Timor-Leste Employment and Environmental Sustainability Fact Sheet 2019 – (ILO, 2019)
- PM2.5 and weather information for Dili: https://www.iqair.com/timor-leste/dili

Summary of Secondary Air Quality Data

The World Bank Timor-Leste Country Environmental Analysis July 2009 summarised air quality as follows:

- At present, outdoor air pollution is a minor problem and is mainly limited to Dili.
- Emissions of greenhouse gases and other pollutants from road transport are modest, given the small number of motor vehicles in use in Timor-Leste.
- Industrial emissions are also limited since the industrial sector represents a small proportion of the economy of Timor-Leste.
- Open burning is also contributing to outdoor air pollution. Open burning of small amounts of waste lowers urban air quality.

The JICA simplified EIA (JICA, 2016) describes air quality as generally acceptable with the exception of dust. Dust arises owing to the poor condition of the roads and dust arising when vehicles pass over unsealed shoulders of roads in many places.

Worley Parsons report baseline air quality data in the Betano Petroleum Refinery and Beaço LNG Plant Strategic EIS (Worley Parsons, 2012a) and the Suai Supply Base EIA (Worley Parsons, 2012b). As part of the EIA studies the assessments showed that most existing sources of air pollutants (dust particles such as $PM_{2.5}$ and gases such as nitrogen dioxide, sulphur dioxide and carbon monoxide) originate from human activities such as dust from roads, vehicles exhaust, power generation exhausts, smoke from cooking stoves and the removal of vegetation. Although, aspects such as total suspended particulates are likely to vary widely during the year due to seasonal effects.

The carbon dioxide (CO_2) emission levels for Timor- Leste have increased sharply by an average of 12 per cent from 2005 to 2014 (Figure 6-31). The increase was due primarily to the energy sector (power generation and transportation). Other sources are: industries; land use change and forestry; and waste. The level of emissions is so much lower than the Asia-Pacific and ASEAN averages that it appears negligible.

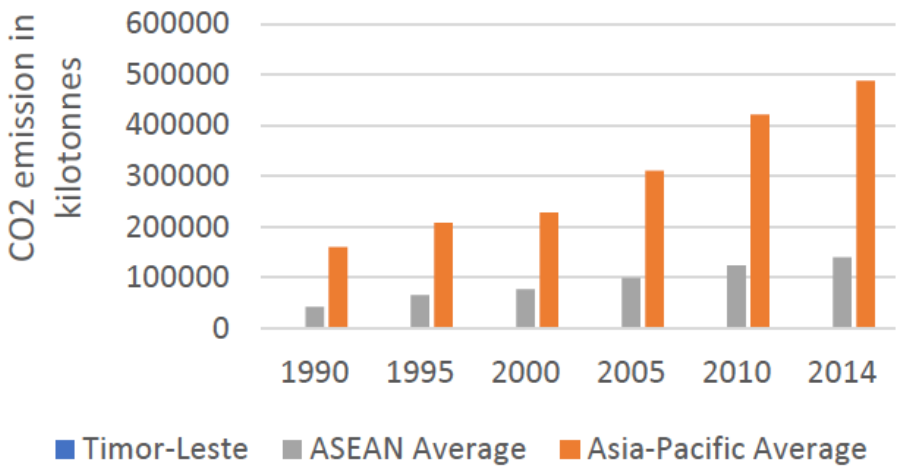


Figure 6-31. CO_2 Emissions for Timor-Leste, 1990- 2014
(after ILO 2019)

Nitrogen dioxide and nitric oxide are formed primarily during the combustion of fuels at high temperatures. In an air quality context, the primary sources of oxides of nitrogen are motor vehicle and power generation exhausts. Sulphur dioxide is also produced by combustion of fuels that contain sulphides, for example diesel or 'sour' natural gas.

Worley Parsons (2012a and 2012b) demonstrated that concentrations of NO_x and SO_x were below the threshold limit of reporting, that is, <1 µg/m^3. In general, the principal gaseous pollutants from traffic CO/SO_x/NO_x are well dispersed in open terrain and there is potentially adequate dispersion in the wide main thoroughfares of the towns and villages. Across the study area most pollutants originate from vehicular traffic and, to a lesser extent, smoke produced from refuse disposal. Current air quality indicators were well below the referenced air quality benchmarks.

Worley Parsons (op cit) noted that in the Suai region, the primary observed sources of air pollutants are vehicular traffic and smoke produced from burning vegetation for agricultural clearing. To a lesser extent, bulk refuse burning and operation of electricity generators also contributes to air pollutants.

Sources of particulate matter can be widespread, ranging from mechanical grinding of materials, wind-generated dust from stockpiles of material, to salt crystals from sea spray. Primary sources of particulate matter are likely to be combustion exhaust from vehicular traffic, smoke from the burning of vegetation and dust generated from agricultural activities (e.g., ploughing fields, livestock movement, grading of roads and paths). Vehicle wheel-generated dust was not observed during the site inspection to be a significant contributor to airborne particulate matter due to the moisture content of the roads and soil although this is likely to be subject to seasonal variation.

The studies concluded that exposure of areas of soil (e.g. vegetation clearing) accompanied by vehicular traffic, will cause localised increases in airborne dust particles ($PM_{2.5}$ and PM_{10}). These dust emissions will diminish and the emission of pollutant gases arising from fixed or mobile plant and equipment (power generation and vehicles) will take on a greater significance; however, these will still be relatively minor at a regional scale.

During construction, air emissions will mainly arise from combustion products resulting from diesel engine exhaust, both the rig and vehicles, occasional gas flaring during well testing.

PM is a common proxy indicator for air pollution (WHO, 2018). It affects more people than any other pollutant. The major components of PM are SO_x, NO_x, ammonia, sodium chloride, black carbon, mineral dust and water. It consists of a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air. While particles with a diameter of 10 microns or less, ($\leq PM_{10}$) can penetrate and lodge deep inside the lungs, the even more health-damaging particles are those with a diameter of 2.5 microns or less, ($\leq PM_{2.5}$). $PM_{2.5}$ can penetrate the lung barrier and enter the blood system. Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases, as well as of lung cancer.

Air quality measurements are typically reported in terms of daily or annual mean concentrations of PM_{10} particles per cubic meter of air volume (m^3). Routine air quality measurements typically describe such PM concentrations in terms of micrograms per cubic meter ($\mu g/m^3$). When sufficiently sensitive measurement tools are available, concentrations of fine particles ($PM_{2.5}$ or smaller), are also reported.

The $PM_{2.5}$ atmospheric particulate matter emission levels for Timor-Leste decreased slightly from 2000 to 2016 (Figure 6-32). Overall $PM_{2.5}$ emission levels exceeded the World Health Organization's Air Quality Guideline threshold level, thus indicating high emissions. Timor-Leste shows lower levels of emission than both the ASEAN and the Asia-Pacific averages

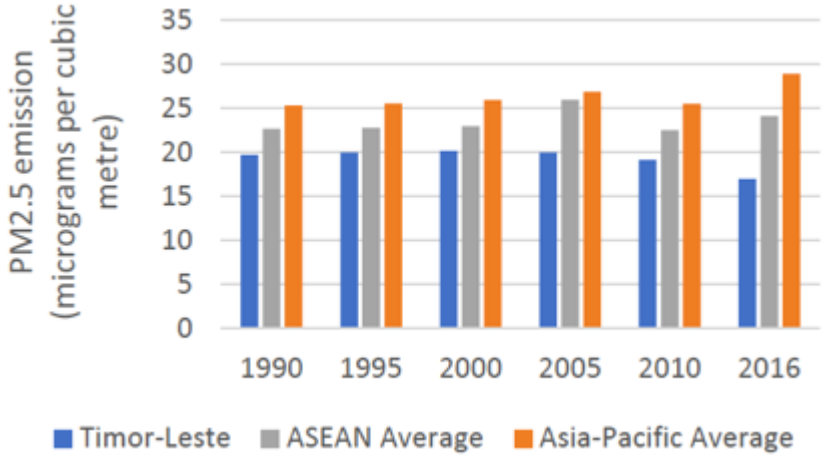


Figure 6-32. PM2.5 emissions for Timor-Leste, 1990-2016 (after ILO 2019)

The Worley Parsons EIA studies (Worley Parsons, 2012a and 2012b) measured average PM_{10} values between 29 $\mu g/m^3$ and 34 $\mu g/m^3$ which is less than the 24-hour average WHO guidelines of 50 $\mu g/m^3$ (see Table 9-13). Both studies indicated a consistent increase in concentrations in the evening between 6:00 p.m. and approximately 8:30 p.m.

The mean annual exposure value for PM $_{2.5}$ in Timor-Leste was 19.26 $\mu g/m^3$ as of 2017 **which exceeds the recommended WHO maximum of 10 $\mu g/m^3$**. Figure 6-33 shows that over the past 27 years this indicator has decreased from a maximum value of 23.76 $\mu g/m^3$ in 2011 to a minimum value of 19.26 $\mu g/m^3$ in 2017. As a result, **in accordance with the World Health**

Organization's guidelines, the air quality in Timor-Leste is considered moderately unsafe as PM2.5 is 19 µg/m^3.

Year	Value
1990	23.06
1995	23.26
2000	23.50
2005	23.25
2010	23.49
2011	23.76
2012	22.47
2013	21.96
2014	20.45
2015	20.62
2016	20.02
2017	19.2

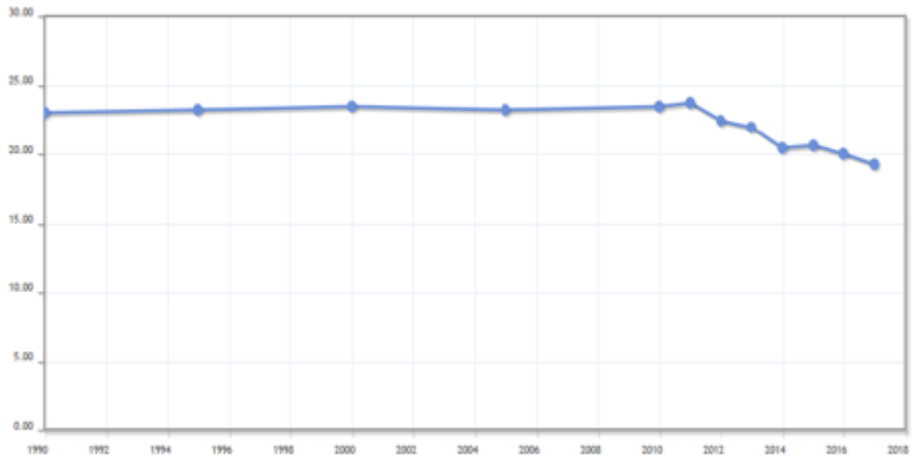


Figure 6-33. Mean Annual Exposure Value for PM2.5 in Timor-Leste. Source: (Index Mundi, 2017)

Summary of Baseline Air Quality Results

Baseline data is summarised in Table 6-5.

The concentration of dust particulate of $PM_{2.5}$ within the drilling area are all within the WHO 24-hour standard of 25µg/m^3.

PM_{10} data at Rusa-1 drilling location are for the most part below or close to the WHO 24-hour standard of 50µg/m^3 with some elevated values between 70 to 86µg/m^3.

The ambient air quality data for Sulphur Dioxide (SO_2) and Nitrogen Dioxide (NO_2) were all below 1µg/m^3, the detection limit of the instrumentation, thus well within the WHO Standards.

Table 6-5. Ambient Air Quality Monitored at Rusa-1 Sensitive Receptors

Aldeia Sesurai
Coordinate: 09^0 06'31.1" S ; 125^0 41'44.8" E

NAME OF ANALYSIS	PARAMETER	UNIT	RESULT	WHO µg/m^3	EQUIPMENT
GAS	NO_2	µg/m^3	0	200	GAS ANALYSER BH-90A
	SO_2	µg/m^3	0	500	
	0_2	%	21.4-21.5	-	
DUST	PM.2.5	µg/m^3	2-4	25	PARTICLE COUNTER HTI HT-9600
	PM.10	µg/m^3	21-86	50	
WIND	Velocity	m/s	1.0-1.5	-	ANEMOMETER Benetech GM 8901
	Wind Direction	-	S-N	-	
HUMIDITY	Temperature	^{0}C	28.7-31.9	-	HUMIDITY METER
	Humidity	%	68.2-75.7	-	

Aldeia Fatukabelak
Coordinate: 09^0 07'05" S ; 125^0 41'33.8" E

NAME OF ANALYSIS	PARAMETER	UNIT	RESULT	WHO µg/m^3	EQUIPMENT
GAS	NO_2	µg/m^3	0	25	GAS ANALYSER BH-90A
	SO_2	µg/m^3	0	10	
	0_2	%	20.9-21.1	30	
DUST	PM.2.5	µg/m^3	2-3	35	PARTICLE COUNTER HTI HT-9600
	PM.10	µg/m^3	46-70	50	
WIND	Velocity	m/s	0.1-1.0	-	ANEMOMETER Benetech GM 8901
	Wind Direction	-	N-S;N-W	-	
HUMIDITY	Temperature	^{0}C	28.6-31.1	-	HUMIDITY METER
	Humidity	%	68.5-75.2	-	

Aldeia Raimerlau
Coordinate: 09^0 06'52.5" S ; 125^0 41'00" E

NAME OF ANALYSIS	PARAMETER	UNIT	RESULT	WHO µg/m^3	EQUIPMENT
GAS	NO_2	µg/m^3	0	25	GAS ANALYSER BH-90A
	SO_2	µg/m^3	0	10	
	0_2	%	20.6-20.9	30	
DUST	PM.2.5	µg/m^3	0-3	35	PARTICLE COUNTER HTI HT-9600
	PM.10	µg/m^3	1-16	50	
WIND	Velocity	m/s	0.0-0.5	-	ANEMOMETER Benetech GM 8901
	Wind Direction	-	S-N	-	
HUMIDITY	Temperature	^{0}C	28.7-29.6	-	HUMIDITY METER
	Humidity	%	73.4-75.5	-	

6.1.4.3 Noise

The study method adopted for this assessment is as follows:

- Identify and present available secondary data sources.
- Identify sensitive receptors (i.e., residences, schools) in the study area (see Table 6-6 also Figure 6-30).
- Collect baseline primary noise data in the study area. This was completed in February 2021.
- Noise data was collected and analysed by identified and experienced local laboratory in accordance with internationally recognised standard, using calibrated hand held instruments as follows:
    - Noise meter Benetech Model: GM 1356 .
    - Anemometer Model/type Benetech GM 8901
    - Data was collected for a continuous 10 minute period each hour over a 24 hour period.
- Examine management measures to minimise noise emissions See Section 9.3.7.
- All the data were compared with international guidance published by World Health Organisation (WHO, 2015).

Literature review

The following are the documents or secondary information sources used for the assessment:

- Tasi Mane Project - Betano Petroleum Refinery and Beaço LNG Plant – Strategic EIS study (Worley Parsons, 2012a)
- Tasi Mane Project - Suai Supply Base – EIA report (Worley Parsons, 2012b)
- The Timor-Leste National Road No. 1 Upgrading JICA (2016).
- WHO noise quality standard – (IFC 2007)

Secondary Data Review

Construction and operational noise associated with the proposed drilling project have been identified as a potential environmental factor with the potential to adversely impact the surrounding environment and communities.

The Betano EIA (Worley Parsons 2017a) recorded weighted average noise levels between 47 dBA and 62 dBA. The Suai Supply Base EIA (Worley Parsons 2017b) recorded weighted average noise levels between 55 dBA and 67 dBA. The Timor-Leste National Road No. 1 Upgrading (JICA 2016) recorded background noise weighted average, at various locations along the route, between 56dBA to 65dBA.

Summary of Baseline Noise Results

Based on the field data most of the noise records are within the WHO standard. Overall the noise levels at the sites are shown to be between 53dB and less than 58dB. The noise level range shows that the noise levels across the drilling area are all less than 70dB (WHO standard for industrial noise level) and the average level is close to the 55db WHO standard for residential areas.

Most of the noise is caused by human activities, such as motor bikes, vehicles, power tools and domestic animals contributes to the current noise environment at the sites.

Table 6-6. Baseline Noise at Sensitive Receptors

Well Site	Location	Sensitive Receptor	Distance (km)	Noise Level (dBA)	Centroid Coordinates	
					Latitude	Longitude
Rusa-1	Aldeia Sessurai	School area	1.06	58	09º 06'31.1" S	125º 41'44.8" E
	Aldeia Fatukabelak	Resident Settlement	0.93	53	09º 07' 05" S	125º 41' 33.8 "E
	Aldeia Raimerlau	Resident Settlement	0.47	53	09º 06 '52.5" S	125º 41" 00" E

6.1.5 Surface and Ground Water

Surface and ground water is used widely throughout the country including Manufahi and Ainaro Municipalities. Observations in the drilling area show that a high percentage of the population use open wells as source of water supply. During the dry season, some of the wells dry out and community turns to rivers as their source of water supply.

Water Quality sampling will be collected using water sampler tool. At each sampling location one water sample will be taken. The water samples will be collected in different locations close to the proposed well site as identified during scouting (Table 6-7). Samples are stored in Polyethylene bottles which are then stored in ice boxes. For certain parameters, preservative reagents are added.

Surface and groundwater quality tests will be performed in situ for physical parameters and by the National Directorate for Water and Sanitation (DNSAS) in Dili for physical, chemical and microbiological parameters. DNSAS as the National Water Testing Laboratory apply their own Laboratory Procedures, Test Methods and Checklist and Standards throughout.

Table 6-7. Groundwater and Surface Water Sample Locations
(Source: Timor Resources 2020)

Well site	Location	Relevant Study area	Distance (km)	Centroid Coordinates	
				Latitude	Longitude
Rusa-1	Aldeia Sessurai	School area	1.06	09º 06'31.1" S	125º 41'44.8" E
	Aldeia Fatukabelak	Resident Settlement	0.93	09º 07' 05" S	125º 41' 33.8 "E
	Aldeia Raimerlau	Resident Settlement	0.47	09º 06 '52.5" S	125º 41" 00" E

6.1.5.1 Study Method

Surface and groundwater quality tests will be performed in situ for physical parameters and at the National Directorate for Water and Sanitation (DNSAS) laboratory in Dili for physical, chemical and microbiological parameters. DNSAS is the National Water Testing Laboratory and apply relevant standards throughout. The following parameters are measured:

A. Physical Parameters:

The physical tests were done onsite using equipment such as pH Meter, Conductivity Meter, Gravimetry and Turbidity Meter. Parameters to be measured include:

- pH Level
- Electrical Conductivity

- Turbidity
- Salinity
- Total Suspended Solid (TDS)
- Total Dissolve Solid (TDS)
- Temperature

B. Chemical Parameters:

The chemical tests at the DNSAS Laboratory use spectrophotometer, comparator and titration methods. Parameters measured include:

- Iron (Fe) concentration
- Manganese (Mn) concentration
- Fluoride concentration
- Free Chlorine
- Calcium Hardness
- Sulphate (SO_4^{2-}) concentration
- Arsenic concentration
- Total Alkalinity
- Nitrogen-Ammonia (NH_3-N) concentration
- Nitrate-Nitrogen (NO_3-N) concentration
- Nitrite-Nitrogen (NO_2-N) concentration

C. Bacteriological Parameters

Tests use the Membrane Filtration method to detect the presence of:

- Total Coliform
- E. Coli

D. Sample Collection and Analysis (See examples in Figure 6-34 below)

Samples are collected using sterile Whirl-Pak Sampling Bags and samplers suspended with rope if necessary. The samplers are immersed up to 30 cm below the water surface then poured into the Whirl Pak Bag up to ¾ full.

Where water samples are taken from a tap, the tap is sterilised (by flame) before collection and opened fully to let the water flow for approximately 3 minutes before collection in Whirl-Pak Bags. The collected samples are stored in a cool place (<10°C) for transport to the DNSAS Laboratory in Dili.

Physical:

All test parameters are done according to the reference values of the WHO Drinking Water Quality Guidelines. The physical tests are conducted on site using portable HACH meters and the samples tested according to the standard methods of HACH Suspension meter and HACH 2100Q turbidimeter.

Chemical:

Chemical tests are conducted in the laboratory. The tests use HACH Digital Titrator, model 16900 for determining Total Hardness, Calcium Hardness and Total Alkalinity. This titration method uses EDTA as the titrant that reacts with the free calcium and magnesium ions which mix with the indicators (powder pillow) causing a colour change to blue.

Spectrophotometer methods use HACH DR 3900 on water samples, of no more than 100 ml, which are poured into a cuvette tube then mixed with the regents (powder pillows). While waiting for the reagent and water to be properly mixed, the blank test has to be performed using the water sample with the same volume (100 ml). The blank test is done to trace any contamination before the actual water sample is tested.

Figure 6-34. Example of Ground Water Sampling and Onsite Tests with HACH Instruments

Microbiological:

The microbiological samples are analysed according to the membrane filtration method which use M-Endo Broth medium (Endo agar), this medium is normally used to grow or inoculate the gram negative bacteria such as E.coli. The inoculated bacteria are then incubated for 22-24 hours at 35ºC-37ºC for total coliform and 44ºC-45ºC for E.Coli then the colony growth is counted in the petri-dish under the fluorescent light following the incubation period.

For each location, one sample was collected using WHO guidelines for sample collection. For the purpose of assessment, WHO (2011) guidelines or standard for drinking water is be used to

measure the quality of water sample collected. Table 6-8 below shows the threshold limit value according to the WHO Guideline.

Table 6-8. WHO/Timor-Leste Water Threshold limits

PARAMETERS	UNIT	WHO/TIMOR-LESTE GUIDELINE
Physical Test		
pH value	pH meter	6.5 - 8.5
E. Conductivity	µs/cm	100 µs - 1 ms/cm
TSS	mg/L	
TDS	mg/L	1,000
Salinity	%	
Temperature	°C	
Turbidity	NTU	5
Chemical Test		
NH_3-N	mg/L	1.5
NO_3-N	mg/L	50
NO_2-N	mg/L	3
Iron (Fe)	mg/L	0.3
Manganese (Mn)	mg/L	0.5
Fluoride	mg/L	1.5
Chloride (Cl-)	mg/L	250
Free Chlorine	mg/L	5
Ca Hardness	mg/L	2.5
Total Hardness	mg/L	200
Total Alkalinity	mg/L	500
Sulphate (SO_4)	mg/L	250
Arsenic	mg/L	0.1
Bacterial Test		
Total Coliform	CFU/100ml	0
E.Coli	CFU/100ml	0

6.1.5.2 Rivers

There is one significant river within the proposed drilling area namely Caraulun river (Table 6-9). The river water quality is expected to vary seasonally, but during the wet season the local community fish for small prawns for consumption and sale.

Rusa-1 Location is elevated above the Caraulun River as shown in Figure 6-35 .

Table 6-9. Distance from Drilling Area to River

Distance of Rivers to the nearest Well		Coordinates	
		Lat	Long
Caraulun River	312.78m to Rusa-1	-9.11363	125.68911

6.1.6 Coastal and Marine Water

The drilling location doesn't border on any coastal or marine waters.

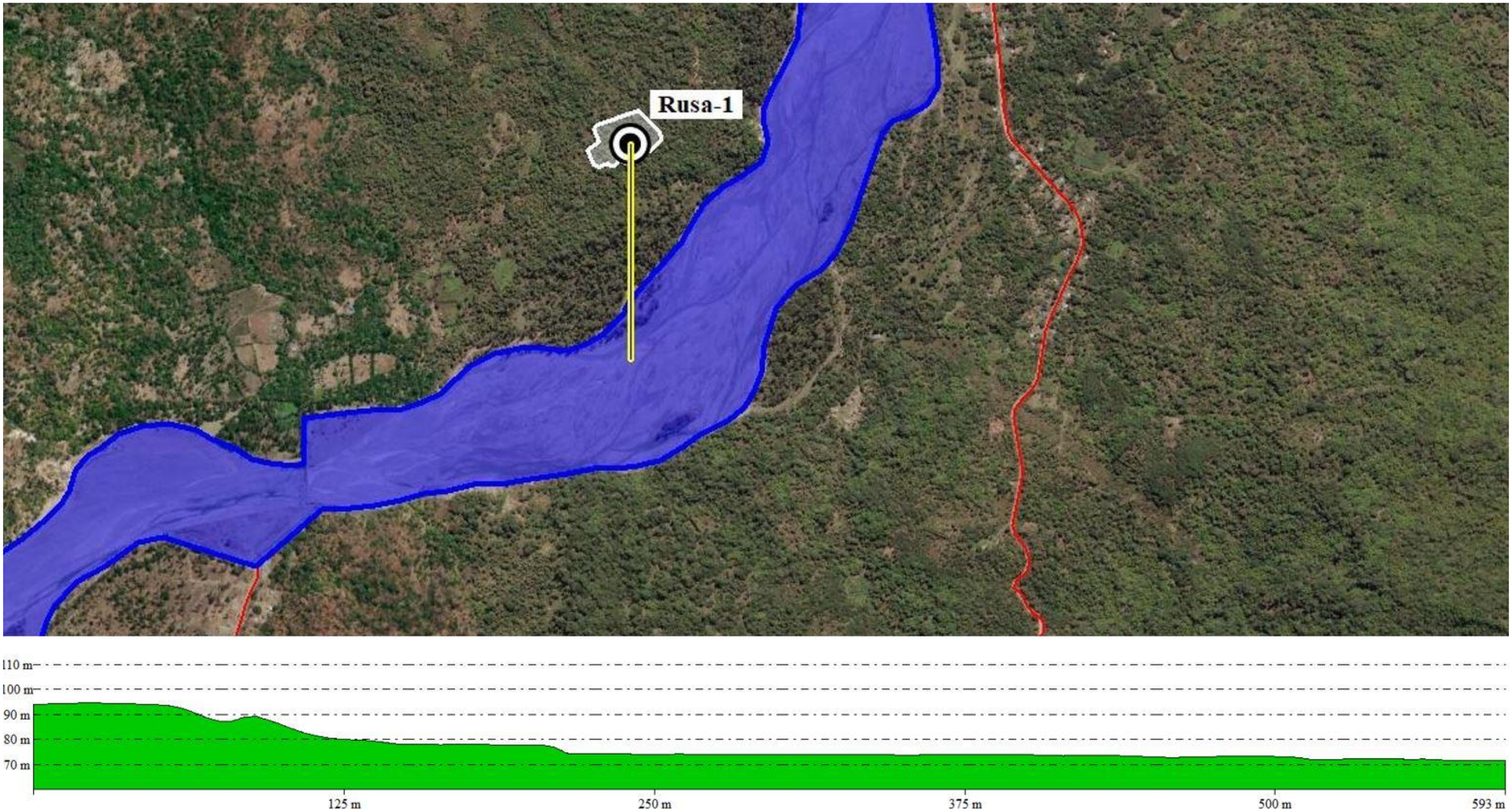


Figure 6-35. Rusa-1 Well Site Location and Elevation

6.1.7 Soil

The first study on soil was undertaken by a soil scientist from Portugal in 1950s to 1960s who did an extensive study on the mainland of Timor and produced a report named "*Carta de solos de Timor* " (JICU 1961) in Portuguese language. Between 2002 – 2006, Seeds of Life collected soil samples from all the districts to examine its pH, phosphorus, and electrical conductivity and other relevant chemical elements. In 2015, WorleyParsons did detail analysis of physical and chemical analysis of soil, however it is not covering all the island but only in Suai, Betano and Beaço, where the Tasi Mane Project is located.

Portuguese soil classifications were amended in 2004 to adapt to USDA (1990) soil classification. The following are the USDA (1990) soil classification categories: Alfisol (soil with aluminium and iron), Andisol (volcanic ash soil), Aridisol (dry soil forming under desert), Entisol (recently formed soil), Gelisol (soil with permafrost), Histosol (organic soil), Inceptisol (young or very recent soil), Mollisol (soft, deep, dark fertile soil), Oxisol (highly weathered soil rich iron and aluminium but low silica), Spodosol (acid soil with organic layer), Ultisol (acid soils in humid tropic), and Vertisol (clay rich soil). There are at least six USDA soil categories (Inceptisol, Mollisol, Entisol, Vertisol, Alfisol and Histosol) and 15 sub-categories that are found in Timor (Thompson, 2011).

Common soils found in Timor are Vertisols, Luvisols and Fluvisols (UN Food and Agriculture Organisation classification scheme). Vertisols are mostly found inland, Luvisols and Fluvisols are found closer to the coastal area (Thompson, 2011). Vertisol contains high clay, at least 35% or more, and is usually covered by natural grassland or woodland. In 2012, Seeds of Life generated soil texture map based on Garcia and Cardoso (1978) data and divided soil texture into ten divisions: clay, clay loam, loam, organic, sand, sandy clay, sandy loam, silty clay, silty loam and variable. Mostly Timor island is covered by clay and loam and rarely organic soil (see Figure 6-36).

Field Method

Soil sampling was conducted at the drilling site during the dry season in May 2020 (coordinates are shown in Table 6-12). Bores were drilled using a 75 mm diameter hand auger to approximately 6 m or practical refusal. Soil samples were collected in zip lock plastic bag to avoid contamination and labelled: Well Name; Sample Number; Depth. See Figure 6-37). Parameters measured are as per the approved TOR Table 6-10 .

Soil chemistry

Soil chemistry data for Timor-Leste is sparse since only a few studies have been conducted over the last 50 years. Between 2000 – 2006 Seeds of Life collected and analysed at least 34 samples from seven districts: Dili, Baucau, Aileu, Bobonaro, Manufahi, Covalima and Liquica. At least seven samples were taken in proximity of the proposed well location.

Measurement of soil acidity from previous study and this study have similar value which good indication for crop viability. From field observation the soil around the proposed drill location are fertilized for teak wood, corn, and other plantations.

Soil metal chemistry will be assessed using a XRF S1 Titan Analyser.

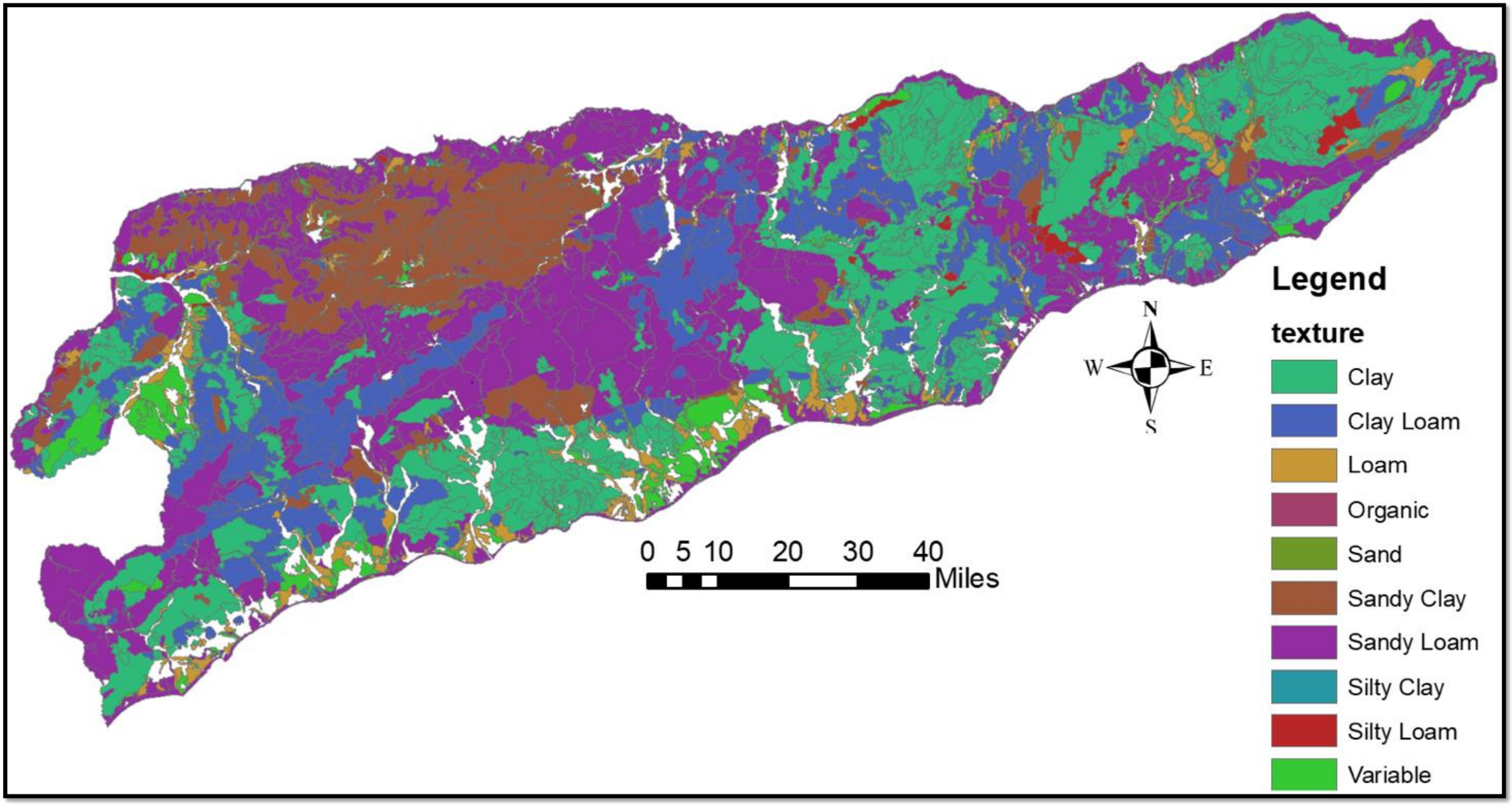


Figure 6-36. Map of soil texture
(Seeds of Life 2012)

Table 6-10. Soil Parameters to be Measured

No	Parameters
1	Moisture
2	Sunlight
3	Soil Temperature
4	Soil pH
5	Potassium
6	Calcium
7	Magnesium
8	Boron
9	Nitrogen
10	Phosphorus
11	Barium
12	Arsenic

Soil sample locations and methods are illustrated in Figure 6-37 and Figure 6-38 . Soil analyses for Rusa-1 are summarised in Section 6.1.7.2 Table 6-11 and Table 6-12 .

Figure 6-37. Sample Locations Rusa-1

6.1.7.1 Literature Review

In the last sixty years not many scholars have undertaken soil studies and published scientific papers about soil of Timor. Both Seeds of Life and Ministry of Agriculture mostly relied on the soil map that was produced by Carta Dos Solos de Timor in 1961. In 2004 Ministry Agriculture and its division ALGIS digitized, reinterpreted, and upgraded the map to reflect modern soil classification (Thompson, 2011). The soil map was referenced to the USDA soil classification for 1990. Worley Parsons did a detailed analysis of soil physical and chemical properties in the Betano area (Worley Parsons 2012a) and the Suai area (Worley Parsons 2012b). A new map of Timor soil texture was published by Seeds of Life and Ministry Agriculture in 2015 (Figure 6-36). The following are the available secondary data sources.

- MAFP, 2015 – Soils of Timor-Leste
- WorleyParsons, 2012a – EIA for Tasi Mane Project, Betano Petroleum Refinery and Beaço LNG Plant
- WorleyParsons, 2012b – EIA for Tasi Mane Project, Suai Supply Base
- S.J. Thompson, 2011 - Geology and Soils in Timor-Leste
- SoL, 2000 – 2006, Chemical and Physical Characteristic of Cassava Soils in East Timor – Seed of Life (SoL, 2006)
- J.S. Garcia and Cardoso, 1978 – Os Solos De Timor

6.1.7.2 Soils Data

Table 6-11. Soil Analysis Report Rusa-1 Well Site

KM'CONSULTING LABORATORY

Rua Caicoli, Aldeia 03, Suco Sacoco, Vera Cruz, Dili, Timor Leste
Email: consulting.km18@gmail.com
Hp +670 77161644 / +670 77094066

Date : May 16, 2020
Send To : Timor Resource Company
Location : National Well Site 1

SOIL ANALISYS REPORT

Sample	LAB Number	Moisture	Sunlight	Soil Temp	Soil pH	SOIL NUTRIENS			Soil Composition (HCL)	PARTICLE SIZE ANALISYS				SOIL DESCRIPTION
						Nitrogen (N)	Phosphorus (P)	Potassium (K)		% Sand	% Silt	% Clay	% Humus	
D.01	0012020	Wet *	Low	29 °C	7	Surplus (N_2=89%)	Surplus (P_4 = 92%)	Surplus (K_4 = 90%)	Carbonate ($CaCO_3$)	12%	14%	66%	8%	Brown to black, Clay < $^1/_{256}$ mm – Medium Sand $^1/_4$-$^1/_2$ mm, alluvium, (Wentworth Scale)
D.02	0022020	Wet *	Low **	29 °C	7	Surplus (N_2=88%)	Surplus (P_4 = 82%)	Surplus (K_4 = 88%)	Carbonate ($CaCO_3$)	77%	17%	2%	4%	Brown to black, Clay < $^1/_{256}$ mm – Medium Sand $^1/_4$-$^1/_2$ mm, alluvium, (Wentworth Scale)

* This Report applies only in the samples tested
** Soil that analisys still in-situ (not transported soil)

Analysis by: Maximiano de Oliveira and Jonas Sambi

Check and Approved by

Emeliano M. G. de Oliveira
Director of KM'CONSULTING

Table 6-12. Summary of Soil Properties Rusa-1 Well Site

No	Date	Coordinate	Location	Weather	Native Vegetation	Composition	Type Soil	Morphology (slope)	Soil Description
D.01	8/5/2020	09^0 06' 39.6'' S 125^0 41' 12.4'' E	Aldeia Raimerlalu (near the community house)	Sunny cloudy	Forest (not dense) mostly teak trees	Carbonate (CaCO3)	In-situ soil or alluvium soil	Alluvium (Lowland-sloping) 2% - 7 %	Characteristic of soil at this point; they are weathering of the source rock and still in-situ with the colour grey to dark, mostly texture gravelly silt with the composition is carbonates because reaction with the HCL
D.02	8/5/2020	09^0 11' 17.1'' S 125^0 68' 79.7'' E	Aldeia Raimerlalu (in the project site)	Sunny cloudy	Rarely teak trees	Carbonate (CaCO3)	In-situ soil or alluvium soil	Alluvium (Lowland) 0% - 4 %	Soil in this site mostly is brown-dark colour with the grain silt-clay mixtures, very compact, well graded, and soil condition is a little bit wet

Figure 6-38. Field soil sampling using Auger hand drilling

6.2 ECOLOGICAL COMPONENTS

6.2.1 Wetland

There are no wetlands in the vicinity of the Rusa-1 well location however the site is bordered by the Caraulun River (see 6.1.5.2 above).

Current literature regarding wetlands in Timor-Leste includes:

- Assessment Report of the Biophysical, Ecological and Socio-Economic Conditions of Mangroves Ecosystem of Timor-Leste (UNDP & MAF, 2017).
- An Introduction to the Convention on Wetlands (previously The Ramsar Convention Manual). (Grobicki, et al. 2016)
- Timor-Leste's Fourth national Report to the UN Convention on Biological Diversity (Democratic Republic of Timor-Leste, 2011)

6.2.2 Mangroves

There are no mangroves in the vicinity of the Rusa-1 drilling area.

6.2.3 Corals

There are no corals in the vicinity of the Rusa-1 drilling area.

6.2.4 Fisheries

Fishing plays an important role as an additional source of livelihood and protein for both coastal dwellers and inland communities (FAO 2009). Rural communities engage in fishing activities seasonally, i.e. during and just after the monsoon and are predominantly carried out for subsistence. State Secretary of Fisheries promotes freshwater fish farming, with aquaculture activities focused on small-scale, "backyard" farming of Carp and Tilapia to increase fish consumption in inland areas. A third species that is promoted by the government is Milkfish. The number of people or households engaged in such small-scale fish farming is about 2,000 and the average size of a fishpond is below 200 m^2. The Government also promotes rice-fish culture to increase local supply of animal protein. Overall, the promotional efforts by the government have led to a steep increase in aquaculture production.

Small-scale coastal fisheries dominate the fisheries sector and there is a substantial artisanal fishery with the vessels mainly being double-outrigger canoes. A total of 20,000 fishers are estimated to be active in artisanal activities (FAO 2009). The majority of the marine capture fishing activities are carried out in nearshore waters, with the catch dominated by small Pelagics and small reef fish. Fish is traded in fresh form with very little production of dried fish. Processing takes place only when fishers estimate that they are unable to sell the fresh catch. Poor transportation infrastructure as well as topography makes distribution of fish difficult, so fishers tend to land their catch close to their respective homes and villages. There is also lack of landing, storage and processing facilities which compounds the problem of fish marketing and trade.

The domestic market for fish thus remains rather underdeveloped and for many upland communities in the country's interior, fish is not a substantial part of their food consumption. The average domestic fish consumption is thus relatively low, with 1.96 kg per capita per year (weight of product actually consumed), with higher consumption levels in the capital Dili and coastal areas (FAO 2009).

Artisanal and subsistence fishing takes place all along the south coast and is important as a food source and a source of cash income (Worley Parsons 2012a), however, no specific fishing areas were identified during the Betano Refinery and Beaço LNG EIA study (Worley Parsons 2012b).

6.2.5 Protected Areas and National Parks

Decree Law 5/2016, March 16 on the National Protected Areas established 46 protected areas across Timor-Leste. Forty-four are located on land and two are marine parks. Protected areas located in Maubisse, Ainaro and Manufahi are Bikan Tidi, Parques Nacional Kayrala Xanana Gusmão, Ribeira de Clere, Welenas Lagoon and Modomahut Lagoon.

The closest protected areas to the Rusa-1 location in Suco Foho-Ai-Lico is Parque Nasional Kayrala Xanana Gusmão a distance of 16.5 km, coordinate: S. 0896606 and E. 125 66177 elevation 601m. See Figure 6-39.

The other protected area is Lagua Modomahut a distance of 29.5 km from Rusa-1 location, coordinates: S. 0904891 and E.125 94720 elevation 52m.

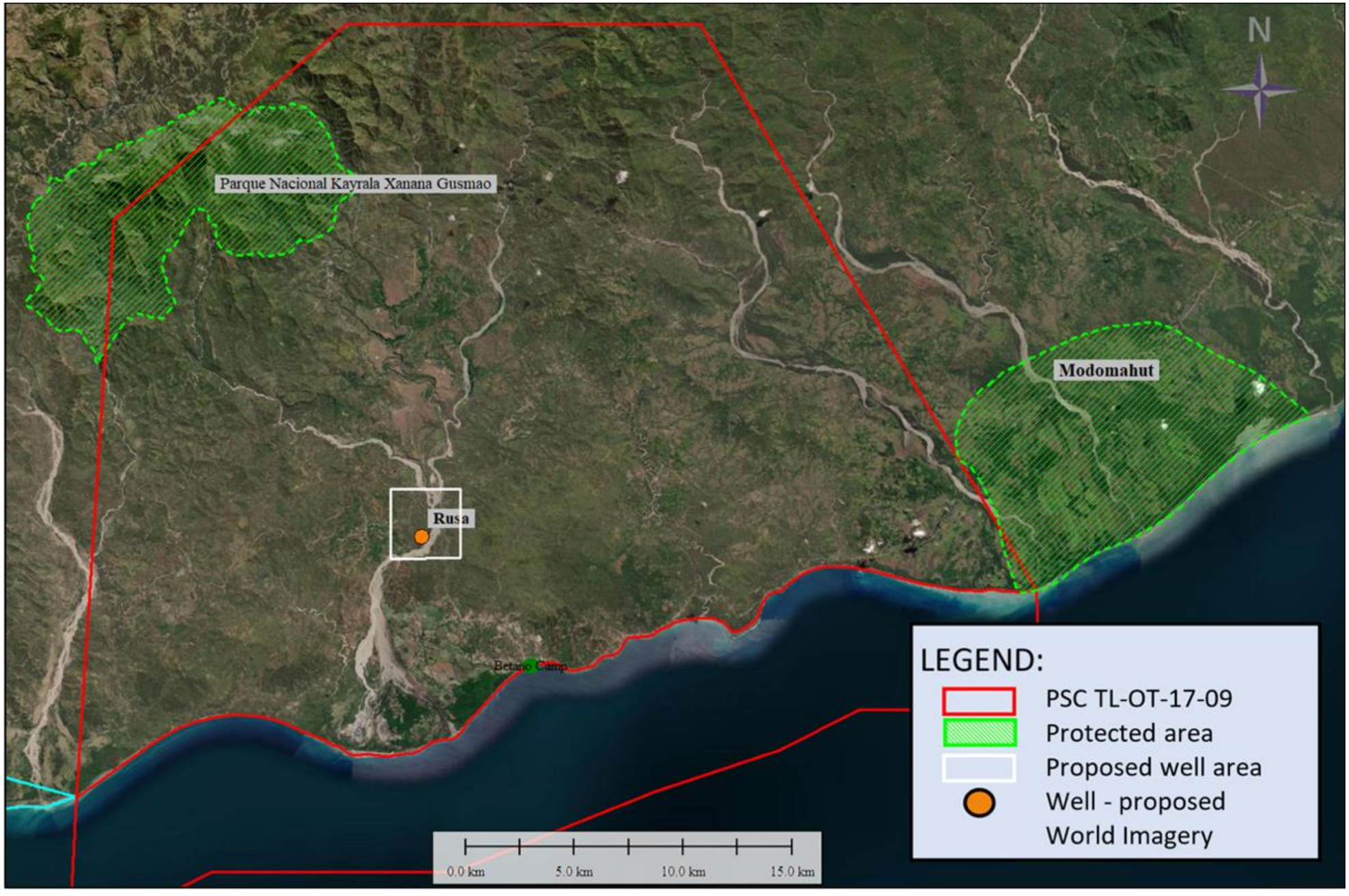


Figure 6-39. Protected Areas related to Drilling Location

6.2.6 Flora and Fauna

6.2.6.1 Study Method

During the environmental baseline survey the transect method was used to identify forest type, species of the flora and fauna that potentially could be impacted by the drilling campaign. Transect lines were drawn up to 1 km from the well location and additionally at 200 meters from the wellhead point of interest. Quadrats (20 x20 meter) were conducted every 200 meters to observe and enumerate flora and fauna within each quadrat.

6.2.6.2 Overall Baseline Condition

Table 6-13 provides a general summary of the overall ecology component in the drilling area. Species are characterised based on the International Union for Conservation of Nature (IUCN) categories such as: Critically Endangered (CR) *Cacatua sulphurea,* four birds species as Near Threatened (NT) and eleven birds species as limited geographic expansion with restricted range (rr).

Mammal species identified and IUCN categorised as: Near Threatened (NT) *Macaca facicularis* and *Phalanger orientalis as* vulnerable (VU).

Reptiles species identified include: *Trimeresurus insularis, Greater reticulated phyton, Gekko gecko, Crocodylus sp, Turtle sp, Hydrophis sp husi family Hydropiidae.*

6.2.6.3 Rusa-1 Well

The types of plants identified at Rusa-1 location, Foho-Ai-Lico are: teak tree *Tectona grandis*, *Coryphaelata*, *Ziziphus sp*, *Scleoreza oliosa*, *Albijia chinensis*, *Ficus sp* including epiphytes.

Flora

Rusa-1 is situated in an agricultural area of farmland belonging to the community from Aldea Baha, Suco Aelico. Adminisrative Post Hatu-Udo, Ainaro Municipality. These are private owner plantation identified within well location: *Tectona grandis* and natural plants and other natural growing trees such as C*oripa elata, Ziziphus sp, Albijia chinensis*, *Ficus sp* and *Cromolaena*.

Type of forest identified in area track 1 to 4, is secondary forest, primary forest, savanna, teak plantation, including agricultural farmland and landscape area. Plants identified in this parcel include: C*asuarina sp, Acasia sp, Ziziphus sp, Scleoreza oliosa, Corypha elata, Ficus sp, Timonia timun, Sterculia foetida*, *Toona sureny*, *Nauclea orientalis*, *Tectona grandis* and *Gmelina arborea*.

Table 6-13. General Summary on Ecological Component

1	Rusa-1 located in Suco Foho-Ai-Lico did not encounter any critical habitat as recorded by the national and also international agreement Ramsar Site.
2	The type of ecosystem identified includes as primary forest, secondary forest, savanna, agricultural production and teak plantation.
3	Other plant species identified and categorised as *limited geographical expansion* which are rare species according to IUCN Agreement.
4	The secondary ecosystem that existing within segment 5 at Rusa-1 location is an important habitat for 26 bird species, particularly *Turacoena modesta* and *Aprosmictus jonquillaceus* considered Near Threatened (NT).
5	Forest segment in parcel 5 from track 1 at a distance of 1.2 km from Rusa-1, identified trees *Pterocarpus indicus* as Near Threatened species (NT) including climbing plants/ bindweed and epiphytes species.
6	Mammals and reptiles species identified outside the Rusa-1 location include: *Macaca Facicularis (NT), Phalanger orientalis (VU)* and *Gekko gecko.*
7	Mammals and reptiles species identified outside the Rusa-1 area include: *Macaca Facicularis (NT), Phalanger orientalis (VU), Trimeresurus insularis, Greater reticulated phyton, Gekko gecko, Crocodylus sp, Turtle sp, Hydrophis sp.*
8	Other bird species of limited geographic expansion (rr) or rare species identified in centre Rusa-1 location such as: *Philimon inornata (NT) no Saxicola Gutturalis (NT),* 6 species with limited geographic expansion (rr)
9	Birds species such as: species *Meliphaga reticulata (rr), Saxicola caprata and Riphidura sp.*
10	Bird species that are originally categorised as common residence in tropical forest, woods, plantations and places, when the drilling activities take place, all species identified will migrate to the same type of forest in other area.
	Notes: *Conservation Status:*
	Vulnerable (VU) *Near Threatened (NT)* *Endangered (EN)*
	Critically Endangered (CR) *Restricted range (rr)*

Parcel area 5 from track 1 at a distance of 1.2 km from Rusa-1 location identified: *Pterocarpus indicu*, endangered species (NT) and secondary forest type as important habitat to wildlife particularly 26 bird species. The distribution of natural resources, socio-economic and cultural within the area are described in Table 6-14 below.

Table 6-14. Natural Resources: Rusa-1

No.	Name	Distance from Rusa-1 Location	Coordinate
1.	Community housing	0.160 km	S. 0911307 E. 12568783 Elevation 81m
2.	Tower Station (EDTL)	0.94 km	S. 0911196 E. 12568809 Elevation 90m
3.	Cultural Site	0.194 km	S. 0911281 E. 12568862 Elevation 78m
4.	Caraulun river	0.295 km	S. 0911422 E. 12568822 Elevation 74m
5	Intik irrigation from Caraulun river	1.4 km	S. 0912122 E. 12567881 Elevation 59m
6.	Important Birds Areas (IBA)	1.2 km	S. 0912033 E. 1256658 Elevation 98m
7.	Agricultural Farmland	0.182 km	S. 0911255 E. 12568578 Elevation 86m
8.	Agricultural Farmland	0.191 km	S. 0911337 E. 12568662 Elevation 65m
9.	Agricultural Farmland, knua and old well	0.466 km	S. 0910858 E. 12568446 Elevation 135m

Some other natural growing trees that have been identified within an area of 100m^2 at Rusa-1 location are listed in Table 6-15 below.

Table 6-15. Rusa-1 Privately-owned Plantations

No.	Species	Total
1.	*Tectona grandis*	261
2.	*Corypha elata*	91
3.	*Ziziphus sp*	13
4.	*Scleoreza oliosa*	5
6.	*Albijia chinensis*	1
7.	*Ficus sp*	1

Fauna

1. Birds

Birds species categorised under IUCN include: *Philemon inornatus* no *Saxicolla gutturalis* limited geographical expansion (rr) includes *Meliphaga reticulata* and *Riphidura sp* identified to live throughout the area.

Primary and secondary forest segment that exist in area 5 track 1, as an important habitat for 26 bird species namely: *Turacoena modesta*, *Aprosmictus jonquillaceus Saxicola Guturalis* and *Philimon inornata*, registered as near threatened species (NT), and 9 bird species of limited geographical expansion (rr). List of birds that identified in Rusa-1 area and track line 1 to 4 are provided in Table 6-16 to Table 6-24 below and mammals and reptiles in Table 6-25 and Table 6-26 .

Table 6-16. List of birds Identified at Rusa-1 Location

No.	English Name	Species	Status	
1	Timor Friarbird	Philemon inornatus	NT	rr
2	White-bellied Bush-chat	Saxicolla gutturalis	NT	rr
3	Streak-breasted Honeyeater	Meliphaga reticulata		rr
4	Olive-brown Oriole	Oriolus melanotis		rr
5	Plain Fairy Warbler	Gerygone inornata		rr
6	Fawn breasted Whistler	Pachycephala orpheus		rr
7	Emerald Dove	Chalcophaps indica		
8	Helmeted Friarbird	Philemon boceroides		
9	Ashy-bellied White-eye	Zosterops citrinellus		
10	Rufous Fantail	Rhipidura rufifrons		
11	Northern Fantail	Rhipidura rufiventris		
12	Pied Bush-chat	Saxicola caprata		
13	Rainbow Bee-eater	Merops ornatus		
14	Barred Dove	Geopelia maugei		
15	Sooty-headed Bulbul	Pycnonotus aurigaster		
16	Southern Boobook	Ninox novaeseelandiae		

Table 6-17. Rusa-1 List of Birds Identified at Track 1 (NT1P1-NT1P5)

No.	English Name	Species	Status	
1	Timor black pigeon	*Turacoena modesta*	NT	rr
2	Timor Friarbird	*Philemon inornata*	NT	rr
3	White-bellied Bush-chat	*Saxicolla gutturalis*	NT	rr
4	Olive-shouldered Parrot	*Aprosmictus jonquillaceus*	NT	rr
5	Streak-breasted Honeyeater	*Meliphaga reticulata*		rr
6	Olive-brown Oriole	*Oriolus melanotis*		rr
7	Fawn breasted Whistler	*Pachycephala orpeus*		rr
8	Plain Fairy Warbler	*Gerygone inornata*		rr
9	Timor Figbird	*Sphecotheres viridis*		rr
10	Rose-crowned fruit dove	*Ptilinopus regina*		
11	Emerald dove	*Chalcophaps indica*		
12	Little Pied Flycatcher	*Ficedula westermanni*		
13	Black-backed Fruit-dove	*Ptilinopus cinctus*		
14	Helmeted Friarbird	*Philemon boceroides*		
15	Ashy-bellied White -eye	*Zosterops citrinellus*		
16	Rufous Fantail	*Rhipidura rufifrons*		
17	Northern Fantail	*Rhipidura rufiventris*		
18	Pied Bush-chat	*Saxicola caprata*		
19	Rainbow Bee-eater	*Merops ornatus*		
20	Barred dove	*Geopelia maugei*		
21	Common kingfisher	*Alcedo atthis*		
22	Spotted dove	*Streptopelia chinensis*		
23	Short-toed Eagle	*Circaetus galilicus*		
24	Red Junglefowl	*Gallus gallus*		
25	Collared kingfisher	*Todiramphus chloris*		
26	Red-cheeked Parrot	*Geoffroyu geoffroyi*		
27	Broad billed flycatcher	*Myagra ruficollis*		
28	Brush Cuckoo	*Cacomantis variolosus*		
29	Sooty-headed Bulbul	*Pycnonotus aurigaster*		
30	Southern Boobook	*Ninox novaeseelandiae*		

Table 6-18. Rusa-1 - Bird Frequency Track 1 *(NT1P1-NT1P5)*

Species	Total Species
Turacoena modesta	2
Philemon inornata	9
Saxicolla gutturalis	8
Aprosmictus jonquillaceus	1
Meliphaga reticulata	15
Oriolus melanotis	3
Pachycephala orpeus	1
Gerygone inornata	5
Sphecotheres viridis	4
Ptilinopus regina	1
Chalcophaps indica	8
Ficedula westermanni	2
Ptilinopus cinctus	5
Philemon boceroides	2
Zosterops citrinellus	6
Rhipidura rufifrons	9
Rhipidura rufiventris	8
Saxicola caprata	3
Merops ornatus	9
Geopelia maugei	8
Alcedo atthis	1
Streptopelia chinensis	2
Circaetus galilicus	2
Gallus gallus	1
Todiramphus chloris	2
Geoffroyu geoffroyi	3
Myagra ruficollis	3
Cacomantis variolosus	1
Pycnonotus aurigaster	3
Ninox novaeseelandiae	1

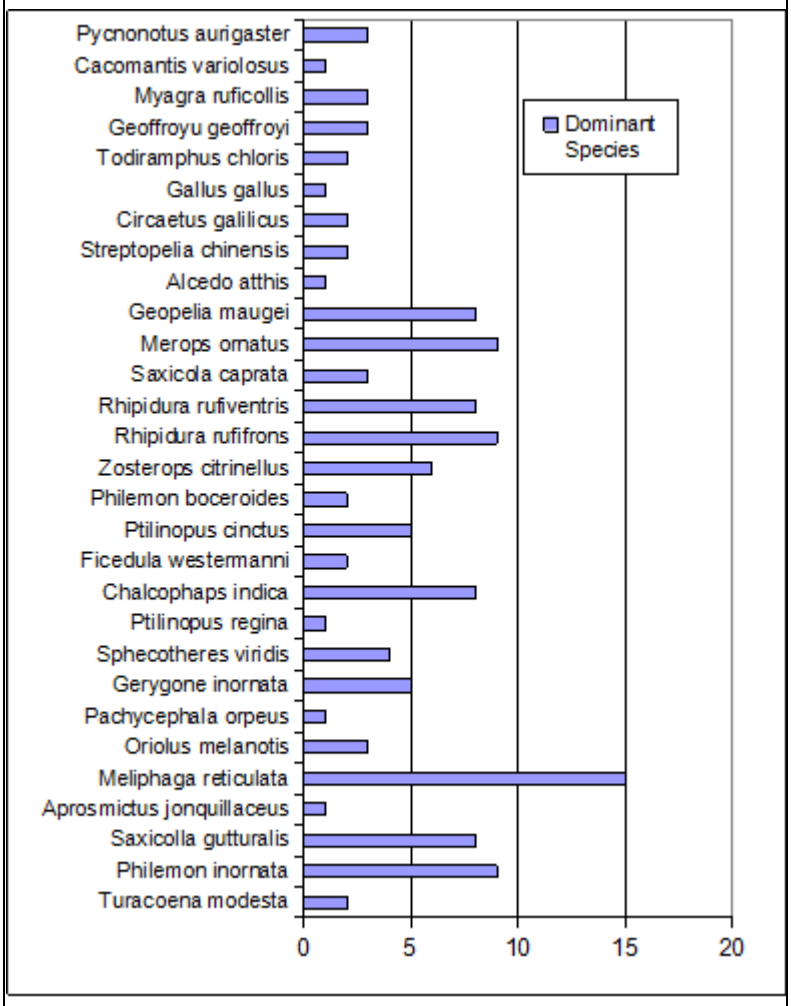


Table 6-19. Rusa-1 List of Birds Identified in Track 2 (NT1P1-NT2P5)

No.	English Name	Species	Status	
1	Timor Friarbird	*Philemon inornatu*	NT	rr
2	White-bellied Bush-chat	*Saxicolla gutturalis*	NT	rr
3	Timor Stub tail	*Urusphena subulata*		rr
4	Streak-breasted Honeyeater	*Meliphaga reticulata*		rr
5	Olive-brown Oriole	*Oriolus melanotis*		rr
6	Plain Fairy Warbler	*Gerygone inornata*		rr
7	Fawn breasted Whistler	*Pachycephala orpheus*		rr
8	Emerald Dove	*Chalcophaps indica*		
9	Helmeted Friarbird	*Philemon boceroides*		
10	Ashy-bellied White-eye	*Zosterops citrinellus*		
11	Rufous Fantail	*Rhipidura rufifrons*		
12	Northern Fantail	*Rhipidura rufiventris*		
13	Pied Bush-chat	*Saxicola caprata*		
14	Rainbow Bee-eater	*Merops ornatus*		
15	Barred Dove	*Geopelia maugei*		
16	Sooty-headed Bulbul	*Pycnonotus aurigaster*		
17	Black Faced	*Lonchura mollucca*		
18	Wallacean Drongo	*Dicrurus densus*		
19	Little Pied Flycatcher	*Ficedula Westermanni*		
20	Spotted Dove	*Streptopelia Chinensis*		
21	Black-backed Fruit-dove	*Ptilinopus Cinctus*		
22	Sooty-headed Bulbul	*Pycnonoyus aurigaster*		
23	Short-toed Eagle	*Circaetus gallicus*		

Table 6-20. Rusa-1 Bird Frequency Track Line 2 (NT2P1-NT2P5)

Species	Total Species
Philemon inornatu	12
Saxicolla gutturalis	2
Urusphena subulata	3
Meliphaga reticulata	17
Oriolus melanotis	3
Gerygone inornata	3
Pachycephala orpheus	2
Chalcophaps indica	4
Philemon boceroides	2
Zosterops citrinellus	1
Rhipidura rufifrons	11
Rhipidura rufiventris	9
Saxicola caprata	8
Merops ornatus	10
Geopelia maugei	5
Pycnonotus aurigaster	2
Lonchura mollucca	3
Dicrurus densus	1
Ficedula Westermanni	1
Streptopelia Chinensis	3
Ptilinopus Cinctus	1
Circaetus gallicus	3

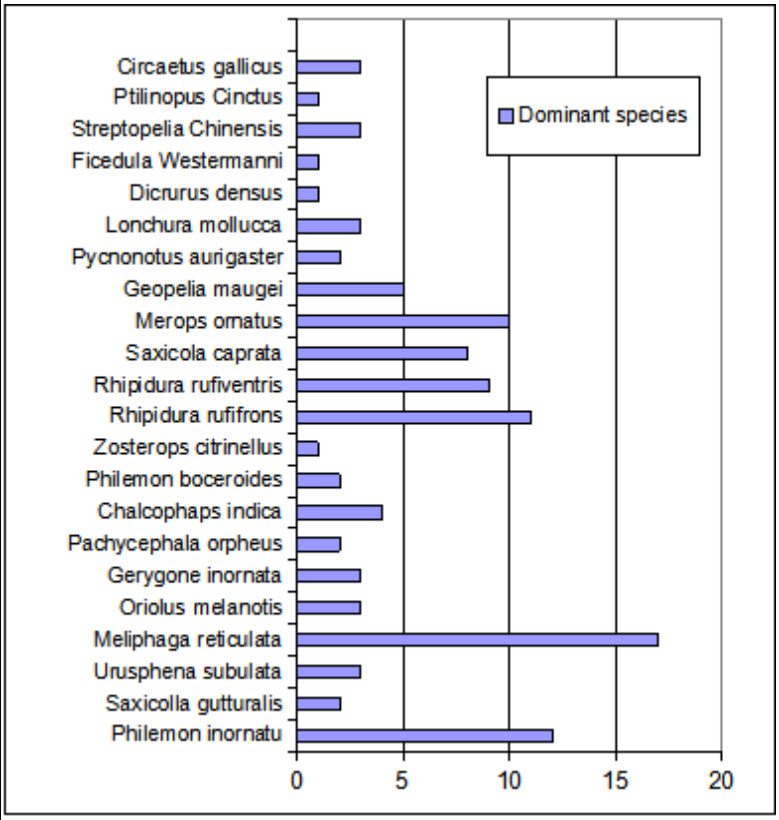


Table 6-21. Rusa-1 List of Birds Identified in Track 3 (NT3P1 - NT3P5)

No.	English Name	Species	Status	
1	Timor Friarbird	*Philemon inornatu*	NT	rr
2	White-bellied Bush-chat	*Saxicolla gutturalis*	NT	rr
3	Streak-breasted Honeyeater	*Meliphaga reticulata*		rr
4	Plain Fairy Warbler	*Gerygone inornata*		rr
5	Pied Bush-chat	*Saxicola caprata*		
6	Rufous Fantail	*Rhipidura rufifrons*		
7	Northern Fantail	*Rhipidura rufiventris*		
8	Rainbow Bee-eater	*Merops ornatus*		
9	Sooty-headed Bulbul	*Pycnonotus aurigaster*		

Table 6-22. Rusa-1 Bird Frequency Track 3 (NT3P1-NT3P5)

Species	Total Species
Philemon inornatu	3
Saxicolla gutturalis	2
Meliphaga reticulata	17
Gerygone inornata	5
Saxicola caprata	2
Rhipidura rufifrons	4
Rhipidura rufiventris	2
Merops ornatus	3
Pycnonotus aurigaster	1

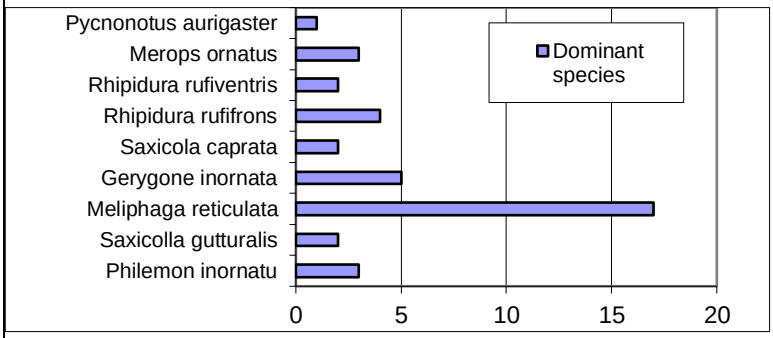
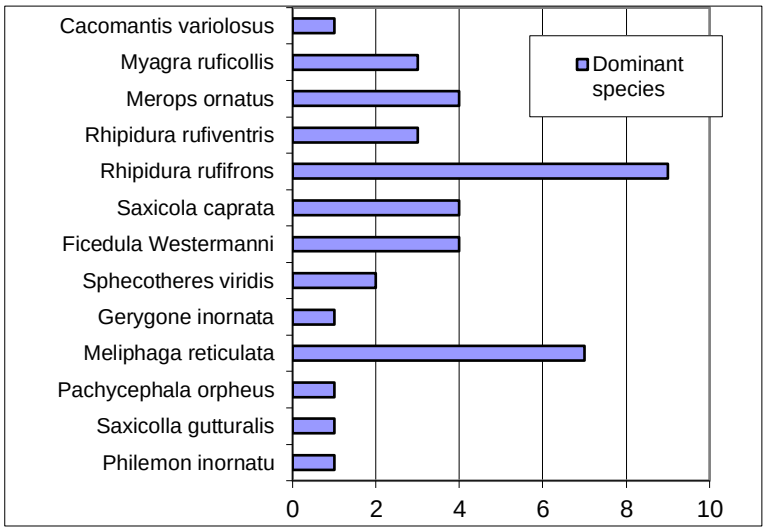


Table 6-23. Rusa-1 List of Birds Identified in Track 4 (NT4P1-NT4P5)

No.	English Name	Species	Status	
1	Timor Friarbird	*Philemon inornatu*	NT	rr
2	White-bellied Bush-chat	*Saxicolla gutturalis*	NT	rr
3	Fawn breasted Whistler	*Pachycephala orpheus*		rr
4	Streak-breasted Honeyeater	*Meliphaga reticulata*		rr
5	Plain Fairy Warbler	*Gerygone inornata*		rr
6	Timor Figbird	*Sphecotheres viridis*		rr
7	Little Pied Flycatcher	*Ficedula Westermanni*		
8	Pied Bush-chat	*Saxicola caprata*		
9	Rufous Fantail	*Rhipidura rufifrons*		
10	Northern Fantail	*Rhipidura rufiventris*		
11	Rainbow Bee-eater	*Merops ornatus*		
12	Broad billed flycatcher	*Myagra ruficollis*		
17	Brush Cuckoo	*Cacomantis variolosus*		

Table 6-24. Rusa-1 Bird Frequency Track 4 (NT4P1-NT4P5)

Species	Total Species
Philemon inornatu	1
Saxicolla gutturalis	1
Pachycephala orpheus	1
Meliphaga reticulata	7
Gerygone inornata	1
Sphecotheres viridis	2
Ficedula Westermanni	4
Saxicola caprata	4
Rhipidura rufifrons	9
Rhipidura rufiventris	3
Merops ornatus	4
Myagra ruficollis	3
Cacomantis variolosus	1



2. Mammals

These are the Mammals species that have been registered within and outside of the Rusa-1 location:

Table 6-25. Rusa-1 Listed Mammals

No.	English Name	Species	Status	
1	Long-tailed macaque	*Macaca facicularis*	NT	
2	Northern common cuscus	*Phalanger orientalis*	VU	

3. Reptiles

The terrestrial reptiles which have been registered withing and outide of well-1 location such as:

Table 6-26. Rusa-1 Listed Reptiles

No.	English Name	Species	Status	
1	Tokay gecko	*Gekko gecko*		
2				

6.2.7 Forests

In general, the economic activities of the local community, especially in Suco Foho-Ai-Lico, Administrative Post Hatu-Udo, Ainaro Municipality, mostly depend on agriculture, forestry, livestock, and fishery.

Based on observations and interviews with the local communities most people rely heavily on the forest resource for their income, to support family needs, including agricultural product, fishery and livestock. Other forms of utilisation of the forest resource includes firewood, construction, furniture and commercial as listed in Table 6-27 .

Table 6-27. Forest Resource and Local Utilisation

No.	Forest Resource	Usage Type
1.	*Tectona grandis*	Construction, furniture and commercial
2.	*Gmelina arborea*	Wood for construction, furniture, and commercial
3.	*Canarium sp*	Wood for construction and furniture
4.	*Casuarina equicetifolia*	Wood for construction
5.	Nauclea orientalis	Wood for construction
6.	*Sterculia foetida*	Wood for construction
7.	(Ai laras)	Wood for construction
8.	(Ai maran)	Firewood
9.	*Bambusa sp*	Not only for construction but also for table and fences
10	*Corypha elata*	The product is not for community consumption neither for animals
11.	(Piku/bebak)	The product is not for construction and fences
12	(Tali tahan)	The product is not for construction
13.	(Tali metan)	The product is not for Sacred House construction
14.	*Imperata cilindrica*	The product is not for Sacred House construction
15.	*Aleurites moluccana*	The product is not for commercial
16.	*Copra (Cocos nucifera)*	The product is not for commercial
17.	(Tua mutin)	The product is not for consumption and commercial
18.	*Coconut oil*	The product is not for consumption and commercial
19.	(Nu'u laloir)	The product is not for consumption and commercial
20.	*Zingiber sp*	The product is not for consumption and commercial
21.	*Curcuma sp*	The product is not for consumption and commercial
22.	*Santalum album*	The product is not for commercial
23.	*Moringa sp*	The product is not for consumption and commercial

Forested areas were estimated to cover 742,000 hectares in 2010, a reduction of 224,000 hectares since 1990 (FAO, 2010). Deforestation is attributable to socio-economic pressures, years of conflict, unsustainable agricultural practices and rapid population increases (RDTL 2011). Many communities are reliant on wood for fuel in cooking and heating (GEF, 2012).

Originally, Timor-Leste was covered by a closed canopy of sub-tropical forest but by 2001 only 16% of the country had a cover of dense forest and 65 % was completely bare (GEF, 2012).

6.2.8 Coastal Resources

There are no coastal resources at the Rusa-1 location.

6.3 ECONOMIC COMPONENTS

The economic aspect in this document depicts the benefit and drawback of the onshore appraisal Drilling Campaign to the community in surrounding areas. Timor Resource owns the contract area defined by PSC TL-OT -17-09, known as PSC TL-OT-17-09, is committed to carry out the drilling campaign that must align with the objectives which are to plan, build and operate the project according to sound industry practice and meet applicable government requirements and appropriate community expectations of environmental performance. For the purpose of this project, the economic component needs to be elaborated explicitly in the EIS document. These components include: employment sector, public infrastructure, land use, use of forest and other natural resources, fisheries, agriculture, tourism, and other industries.

6.3.1 Employment sectors

Most of the population in Suco Foho-Ai-Lico, Post Administrative of Hatu-Udo, Municipality of Ainaro consist of the farmer, commercial activities and fishermen, other are official (civil) servant (approximately 10%) (see for example Table 6-28 and Table 6-29). Frequently these farmers earn their income from selling their local farming products to the customers such as corn, cassava, vegetable, banana, and teak wood. Supplementing their income supported by collecting and selling firewood, construction materials such as sand and rocks that they collected from the nearby rivers. The small business owner established their mini stores (Kiosk); however, with only a small quantity of services provided. Due to their daily low income or limited source of revenue resulted in some of the local communities live under the poverty line.

Based on a survey on April 2020, it is demonstrated that aside from farming they also involve in livestock namely cattle, buffalo goats and chicken. Related to high population growth which is about 3% annually, rapid urbanization and slow rate of job creation all have contributed to the poverty concern. Approximately, 41% of the total population along the affected area lives on revenue less than $1 per day.

There is an enormous gap in terms of income compared to people living in Dili - recalling that women are more likely to be involved in sales and services. The following tables illustrate the economic activity in and around Suco Foho-Ai-Lico, Post Administrative of Hatu-Udo, Municipality of Ainaro, based on the 2015 Census data from the National Directorate for Statistic, Ministry of Finance. Moreover, according to the socio-economic survey conducted in 2020, it is found that there are no significant changes in the employment sector because most the community still inhabit their previous way of surviving which is through farming.

Table 6-28. Main economic activity for the population aged ten years above
(Census, 2015)

LOCATION	Main Economic Activity			TOTAL
	Employed	Unemployed	Economically Inactive	
Post Adm. of Alas	2.844	71	2.865	5.780
Manufahi Municipality	19.471	445	20.043	39.959

The labor strength engaged during drilling will depend upon activities, since many activities are labor intensive. Most of the unskilled labor will be possibly acquired from the nearby villages and towns. In addition to direct employment, several opportunities for locals will be available in terms of supplier of goods and services during operation. It is believed that this project will provide job opportunities to local community – skilled individuals will be acquired from the community within the boundary of the project area through company's selection criteria.

Table 6-29. Employment Sectors

LOCATION	Main Economic Activity			TOTAL
	Employed	Unemployed	Economically Inactive	
Suco Foho-Ai-Lico	2.028	130	1.484	3.624
Post Administrative of Hatu Udo	4.206	170	3.266	7.642
Ainaro Municipality	22.775	778	21.116	44.669




6.3.2 Infrastructure facilities

Since the independence, Timor-Leste's public infrastructures start to develop rapidly in certain areas - especially the development of the roads, bridges and electricity in the country. The result of the field survey conducted in Suco Foho-Ai-Lico, Post Administrative of Hatu-Udo, Municipality of Ainaro shown that there are some old structures built during Indonesian occupation and still exist at the present time which are still significantly useful for the local community to assess this facility to transfer their local product to the markets. Considering its long existence, the safety factor of these old structures are now decreasing.

On the other hand, other public infrastructures namely: electrical poles (power line), schools, church, hospital (clinic), water tanks/reservoir, irrigation system and others are also found along the project area (Figure 6-40). The national road from Berloic Uma (Manufahi Municipality) to Natarbora (Manututo Municipality) is still under construction and some parts still utilize the previous roads. Moreover, some villages in Suco Foho-Ai-Lico still lack basic infrastructure facilities - no electricity (they only used solar panels provided by the government) and the road is still in poor condition. These infrastructures expected to help and improve the livelihood of the local community in terms of social and economic life.

Bridge

Fresh water

Electricity Pole

Church

Health care centre

School

National roads

Storm Drainage

Figure 6-40. Infrastructure facilities surrounding project boundary

6.3.3 Land Use

During the field survey, it is found that the populations living along the project area utilize the vacant land they owned mostly for agricultural purposes - to grow fruits (banana, jackfruits) corn, cassava, rice, vegetables and some plant teak trees; since it is quite a distanced from their homes, they cannot ensure adequate monitoring and maintenance throughout the lifecycle of the plant. In addition, due to lack of technical capabilities, some of those areas with good potential to be utilized for farming are abandoned. For the Rusa-1 Well, the area categorised as low relief with a small creek surrounding the drilling area. The land use is mainly for agricultural purposes.

6.3.4 Use of Forest and Other Natural Resources

Communities in direct and indirect area of influence of the project is heavily reliant on the plantation products which are also land that is filled with teak trees, where used by the surrounding community to build houses, sometimes they sell it to other customers. Other natural resources originating from rivers are namely rocks, sand and surface water intended for irrigating rice fields and other agricultural-related to communities that resided along the river bodies, besides that, some people also search and carry out fishing for their daily meal.
Table 6-30 shows target areas for forest conservation across Timor-Leste.

Table 6-30. Target areas for forest conservation in thirteen districts by 2023

District name	Dense Forest	Sparse Forest	Sub-total forest area	Sub-total non-forest area	Total area	Number of corresponding Suco
Important forest area for Water Resource, Soil Conservation and Biodiversity (Total)						
Lautem	40,568.85	22,025.34	62,594.19	19,612.98	82,207.17	13
Viqueque	34,182.45	36,787.23	70,969.68	21,955.23	92,924.91	21
Baucau	14,603.76	20,210.67	34,814.43	19,808.73	54,623.16	26
Manatuto	41,800.05	58,488.75	100,288.80	29,622.06	129,910.86	26
Manufahi	16,325.46	20,327.58	36,653.04	13,604.13	50,257.17	21
Ainaro	10,171.71	12,497.13	22,668.84	22,005.99	44,674.83	14
Aileu	7,875.27	20,193.75	28,069.02	27,655.56	55,724.58	16
Dili	4,301.37	8,311.95	12,613.32	7,129.08	19,742.40	6
Liquica	16,322.67	9,606.60	25,929.27	15,860.25	41,789.52	22
Ermera	13,010.85	7,583.40	20,594.25	19,161.72	39,755.97	27
Bobonaro	8,762.04	16,359.75	25,121.79	15,620.13	40,741.92	18
Covalima	16,151.49	31,560.39	47,711.88	20,673.27	68,385.15	19
Oecusse	4,098.60	15,046.65	19,145.25	5,799.42	24,944.67	4
Total	228,174.57	278,999.19	507,173.76	238,508.55	745,682.31	233

Source: MAF. (2018). *Final Country Report of the Land Degradation Neutrality Target Setting Program in Timor-Leste*. Retrieved from: https://knowledge.unccd.int/sites/default/files/ldn_targets/2019-01/Timor-Leste%20LDN%20TSP%20Country%20Report.pdf (Accessed: 05 February 2021)

6.3.5 Fishing

Total area of Timor-Leste is 16,000 km^2 with a coastline around 706 km in length and marine economical jurisdictions area of approximately 75,000 km^2. Despite its long coastline and apparent abundant fishery resources, this sector is still deemed underdeveloped, people mostly eat what they catch with a small percentage of the catch sold to provide cash income from fishing-related activities during the past year. For additional detail see 6.2.4 .

6.3.6 Agriculture

To a great extent in the last century, agriculture has become the backbone of Timor-Leste's economy. Most of the population lived along the project area heavily relies on the agricultural sector as a way of sustaining their daily life. It has been reported that agriculture is the main activity in Timor-Leste, providing subsistence to an estimated 80 percent of the population and it also generates an average of 90 percent if the country's exports (Timor-Leste Agricultural Census 2019).

Approximately 50% of the population lives in rural areas and most of these practise subsistence agriculture. Agricultural practices that exists in the villages near to the well location are mainly similar compared to other villages throughout Timor-Leste. The existing agricultural products predominantly sweet potato, potato, corn, cassava, vegetable banana, rice, beans, peanut, etc. Some other involved in livestock typically includes cattle, buffalo, pig, chickens and goats. In terms of qualitative aspect, it is still below the standard because the farmers still lack of management skill otherwise it will generate more income for the local community.

Table 6-31 list the household agriculture products and quantity produced both individually and collectively for their purposes as listed in the level of agriculture activity.

Table 6-31. List of household products and quantity identified in the census 2015.

Manufahi Municipality												
Administrative Post	Type of crop produced											
	Rice	Maize	Cassava	Sweet potato	Vegetables	Beans	Coffee	Coconut	All Seasons Fruits	Seasonal Fruits	Timber trees	Others
Alas	532	1,170	1,193	1,016	1,173	1,026	495	922	774	730	821	427
Fatuberlio	806	1,173	1,154	1,105	1,080	1,041	509	996	915	965	681	287
Same	1,198	4,594	4,507	4,096	3,851	4,191	3,013	3,208	3,595	3,610	2,278	1,546
Turiscai	125	1,081	984	945	782	632	937	221	698	669	189	222
TOTAL	**2,661**	**8,018**	**7,838**	**7,162**	**6,886**	**6,890**	**4,954**	**5,347**	**5,982**	**5,974**	**3,969**	**2,482**

Ainaro Municipality												
Administrative Post	Type of crop produced											
	Rice	Maize	Cassava	Sweet potato	Vegetables	Beans	Coffee	Coconut	All Seasons Fruits	Seasonal Fruits	mber tre	Others
Ainaro	702	2,199	2,201	2,138	1,636	1,683	1,737	1,407	1,632	1,558	1,413	906
Hato-Udo	631	1,795	1,749	1,635	1,564	1,645	694	1,644	1,578	1,551	1,722	1,090
Hato-Builico	316	2,049	1,526	1,751	1,704	857	1,484	480	1,409	1,495	437	468
Maubisse	1,085	3,433	2,734	3,075	2,836	1,737	3,071	1,145	1,673	1,902	1,028	1,086
TOTAL	**2,734**	**9,476**	**8,210**	**8,599**	**7,740**	**5,922**	**6,986**	**4,676**	**6,292**	**6,506**	**4,600**	**3,550**

6.3.7 Tourism

Manufahi municipality stretches from the central mountains to the southern coast. Inland, scenic vistas of the large mountains and expansive valleys are magnificent. Small villages can be found along the roads and on isolated ridges. Travelling South, the road from Dili winds down steeply after Aitutu and follows a lush green river valley towards Same, the administrative capital of Manufahi. The local climate and terrain are well suited to the cultivation of many tropical fruits and vegetables, plus Timor-Leste's famous organically grown coffee.

Same offers a great base for exploring the surrounding areas. In the South of the same city has spectacular scenery and provides wonderful view for exploring and hiking as we know Mt. Kablaki through dense forests and small villages is an ideal way to experience the natural beauty of the area and the nearby river is good for swimming. Same also has some exquisite old Portuguese buildings.

From Same the road continues on further South to Betano, a small fishing village on the coast with long sweeping black sand beaches. This was the location where Australian Sparrow Force guerrilla troops had to be evacuated by ship and submarine during WWII. Much of the coastal area known as Sungai Clere further to the east of Betano have been proposed for protection as a wildlife sanctuary. This wetland area and the hill country inland area to its North are very isolated and often inaccessible by road in the wet season.

The tourism of Timor-Leste is stepping slowly among the tourism of other countries in the world. However, it offers a variety of facilities for tourists. Timor-Leste was not originally a popular tourist attraction for foreign tourists, but has recently begun to refine itself and start to become the most important part for foreign tourists to visit due to the economic and the security situation is gradually improving.

There are no major tourism places nearby the affected project area, however, there are some old structures that were built during Portuguese time (Figure 6-41) and Jardim dos Herois e Martires da Patria (Figure 6-42) and Parque Dom Boa Ventura (Figure 6-43). The closest well to the Parque Dom Boa Ventura is Rusa Well with the approximate distance of 4.5 km. These tourist attraction sites are located in Same.

Figure 6-41. Old Portuguese building

Figure 6-42. Jardim dos Herois e Martires da Patria

Figure 6-43. Parque Dom Boa Ventura

6.3.8 Other Industries

Based on the field survey, it is found that there is no major industries located nearby both sucos - these places are still free from air pollution, nor any major environmental issues cause by any newly open project. Moreover, there is only small business enterprises (mini store) own by some of the community members within the neighbourhood; hence, the is no new establishment expected to provide any benefits to local community.

6.4 SOCIAL COMPONENT

Social component of this environmental impact statement will include populations and communities affected by the drilling campaign. Populations demographic such as number, composition, employment, unemployment, health profiles and infrastructure facilities (Institutional building, schools and hospitals) will be assessed and evaluated. Community and family structures in the project area will also be considered as well as land ownerships or any other rights over lands. In addition, individual rights over natural resources on the project area have to be considered and recompensed (if necessary) during the design, preparation and implementation of the project. As indicated, several social components needs to be identified and properly assessed in order to maintain a good project implementation practice that is mutually beneficial to the project as well the communities and environments in the nearby settlements.

6.4.1 Populations and Communities

According to the projection of the Department of Statistics, Ministry of Finance, in 2020 Timor-Leste has a population of approximately 1.3M (estimate) with 1.5% annual growth rate. The country is divided into 13 municipalities, 65 administrative posts, 451 Sucos and 2,233 Aldeias. The last population and housing census was conducted in 2015 as summarize in Table 6-32 below.

Table 6-32. Summary of Timor-Leste demographic

Municipalities	Projected Number of Populations	Number of Households	Land Area km^2	Population Density / km^2
Aileu	53,009	7,598	676.02	78.4
Ainaro	64,616	10,600	869.80	73.9
Baucau	125,328	22,976	1,507.95	83.1
Bobonaro	99,205	17,635	1,380.82	71.8
Covalima	67,495	12,564	1,206.66	55.9
Dili	304,889	42,485	368.12	828.2
Ermera	132,054	20,671	770.83	171.3
Lautem	66,728	12,050	1,813.11	36.8
Liquica	75,909	11,885	550.95	137.8
Manatuto	47,806	7,467	1,785.95	26.8
Manufahi	55,130	9,023	1,326.60	42
Oecusse	71,132	14,345	817.23	87
Viqueque	78,265	15,297	1,880.39	41.6
TOTAL	1,191,578	204,596	14,954.43	79.7 (Overall Population density)

Source: Department of Statistics, Ministry of Finance, "Timor-Leste Population and Housing Census 2015 (Municipios em Numero)".

Table 6-33 below list out the number of Sucos, Aldeias and the area size (in percentage) for each one of the Post Administrative in Ainaro and Manufahi Municipalities.

Table 6-33. List of Ainaro and Manufahi Post Administratives and their Sucos and Aldeias.

Ainaro Municipality					
Post Administrative	**Sucos**		**Aldeias**		**Area size (%)**
	No. of Sucos	**Name**	**No. of Aldeias**	**Name**	
Ainaro	7	Ainaro, Cassa, Manutaci, Mau-Nuno, Mau-Ulo, Soro, Suro-Craic	31	Builico, Hato-Mera, Lugatu, Nugufu, Sebagulau, Teliga. Boltama, Civil, Lailima, Mau-Suca Bemoris, Queca-Mau. Bau-Hati-Lau, Canudo, Hato-Meda-Udo, Rae-Buti-Udo. Aileu, Mama-Lau, Mau-Suca. Dagamessa, Hato-Lau, Hato-Lelo, Mau-Ulo-Pu, Mau-Ulu-Lau. Guer-Udo, Leolala, Poelau, Terlora. Ailau, Bazar, No-Ulo, Ria-Mori	27.13%
Hatu-Udo	2	Foho-Ai-Lico, Leolima	16	Ailora, Ainaro-Quic, Baha, Lebo-Mera, Lesso, Raimerlau. Aimerleu, Dausur, Goulau, Groto, Hutseo, Lesse, Luro, Nuno-Boco, Rae-Soro, Suro-Craic.	27.94%
Hato-Builico	3	Mauchiga, Mulo, Nuno-Mogue	21	Goulora, Hato-Quero, Leotelo I, Leotelo li, Mauchiga. Aituto, Bleheto, Hautio, Mano-Mera, Maulahulo, Mulo, Queorudo, Tatiri. Hato-Builico, Hato-Seraquei, Laqueco, Lebulau, Mausoromata, Nuno-Mogue-Lau, Querema, Tucaro.	14.93%
Maubisse	9	Aituto, Edi, Fatubessi, Horai-Quic, Liurai, Manelobas,	63	Aihou, Airaca-Lau, Betulala, Goulolo, Hato-Buti, Lebututo, Lientuto, Mau-Lefo, Russulau. Demutete, Hebau, Lobibo, Rai-Mera, Talale, Tali-Felo. Caitara, Cassimidei, Hohulo, Rae-Buti-Lau, Titibauria, Tutu-Fili. Cartolo, Gourema, Hatussao, Lau-Heli. Bere-Tai, Erbean, Hoho-Naro, Mau-Mude.	30.00%

Ainaro Municipality					
Post Administrative	**Sucos**		**Aldeias**		**Area size (%)**
	No. of Sucos	**Name**	**No. of Aldeias**	**Name**	
		Manetu, Maubisse, Maulau		Cotomata, Ernaro, Hautei, Hautilo. Boro-Ulo, Dau-Lelo, Hahi-Tali, Lebo-Luli, Mau-Lai, Quiri-Coli, Russulau. Cano-Rema, Goulala, Hato-Fae, Hato-Luli, Hautado, Lequi-Tei, Ria-Leco, Ria-Mori, Sarlala, Teli-Tuco, Ura-Hou, Vila. Aihosan, Hahi-Mau, Hato-Cade, Hato-Lete, Laca-Mali-Cau, Lumo-Luli, Maleria, Rita, Tara-Bula, Ussululi, Buibela	
Total	**21**		**131**		**100%**

Source: DGE. (2018). *Ainaro em números: Estatística Município de Ainaro 2018*. 6°Edição 2018.Retrieved from https://www.statistics.gov.tl/wp-content/uploads/2020/03/Ainaro-em-Numeros-2018.pdf (Accessed: 04 February 2021).

Manufahi Municipality					
Post Administrative	**Sucos**		**Aldeias**		**Area size (%)**
	No. of Sucos	**Name**	**No. of Aldeias**	**Name**	
Alas	5	Aituha, Dotik, Mahaquidan, Taitudac, Uma Berloic	19	Leo dato, Rai Kesa. Lacaluan, Sarin, Weberec. Beremanek, Debuwain, Knua Alas, Tahu Bein, Uma Mean. Ailora, Kakeuk Laletek, Lurin, Mahaklusin, Manus. Baria Laran, Colocau, Culuhun, Uma Feric.	30.68%
Fatuberliu	5	Bubussuso, Caicassa, Clacuc, Fahinehan, Fatukahi	23	Aituha, Bubulora, Bubussusso, Lihu Lau, Orlora. Ailalec, Bubur Laletec, Caicassa, Sucaer Oan. Mane Hat, Nalolo, Saluquim, Tiro, Webicas. Ainessi, Daramata, Daurata, Riamori. Cledic, Fatubesi, Fatuboe, Fatumutin, Fuquiran.	28.34%
Same	8	Babulo, Betano, Dai-Sua,	55	Lapuro, Lia-Nai, Nunu-Fu, Raimera, Searema, Turon, Uma-Liurai, Uma-Luli. Bemetan, Lalica, Leo-Ai, Loro, Rai-Fussa, Selihassan, Sessurai. Dai-Sua, Leco-Ai, Leco-Lau, Loti, Riatu.	26.78%

Manufahi Municipality					
Post Administrative	**Sucos**		**Aldeias**		**Area size (%)**
	No. of Sucos	**Name**	**No. of Aldeias**	**Name**	
		Grotu, Holarua, Letefoho, Rotuto, Tutuluro		Coli Dassi, Dato Rae, Leo Dato. Anilumo, Blaro, Carbulau, Datina, Deunai, Fahiluhan, Falitehu, Fatuco, Hatu-Rae, Orema, Russo, Tirilolo, Uru Fu. Ailuli, Cotalala, Ladiqui, Manico, Rai-Ubo, Ria-Lau, Tomonamo. Bere-Teni, Foe-Hei, Hatu-Hei, Leo-Fat, Sabou. Ailau, Batas, Bubolau, Dalun, Hastetuc, Roin, Sosemera.	
Turiscai	11	Aitemua, Beremana, Caimauc, Fatucalo, Foholau, Lessuata, Liurai, Manumera, Matorec, Mindelo, Orana.	40	Furak Lau, Laclo. Beremana, Dalubo, Fahilebo. Bussacoa, Fohua, Lemano, Railete, Risso. Darufu, Ermori. Leubuti, Lutarmata, Tarabula. Ailulimau, Bitibo, Lebucoa, Namoluli. Bilimano, Fanolelo, Fohonaru, Markoluli, Titilawai, Turiscai Lau. Assumata, Cotalaulara, Faturedalau, Toilero. Fatu Hei, Foho Tu, Orluli, Rimori. Aidila, Binani, Maubissi, Orcenaco. Fatulelo, Orana, Teberai.	14.20%
Total	**29**		**137**		**100%**

Source: DGE. (2018). *Manufahi em números: Estatística Município de Manufahi 2018*. 6°Edição 2018.Retrieved from: https://www.statistics.gov.tl/wp-content/uploads/2020/03/Manufahi-em-Numeros-2018.pdf (Accessed: 04 February 2021).

Ainaro and Manufahi have about almost equal number of populations for male and females. Table 6-34 provides detail numbers of Ainaro and Manufahi projected total population by age group and gender reported by the General Directorate of Statistics (DGE) Timor-Leste in 2018.

Table 6-34. List of Ainaro and Manufahi projected total population by age group and gender

Ainaro Municipality, 2015 Census			
Age Group	**Male**	**Female**	**Total**
Under 1	925	786	1,711
1-4	3,689	3,431	7,120
5-9	4,981	4,515	9,496
10-14	4,786	4,491	9,277
15-19	3,842	3,616	7,458
20-24	2,074	2,081	4,155
25-29	1,792	2,017	3,809
30-34	1,661	1,730	3,391
35-39	1,268	1,339	2,607
40-44	1,587	1,435	3,022
45-49	1,349	1,064	2,413
50-54	775	696	1,471
55-59	596	528	1,124
60-64	677	682	1,359
65-69	1,164	1,484	2,648
70-74	522	549	1,071
75-79	258	255	513
80-84	124	132	256
85+	111	124	235
Total	32,181	30,955	63,136

Source: DGE. (2018). *Ainaro em números: Estatística Município de Ainaro 2018*. 6°Edição 2018.Retrieved from: https://www.statistics.gov.tl/wp-content/uploads/2020/03/Ainaro-em-Numeros-2018.pdf (Accessed: 04 February 2021).

Manufahi Municipality, 2015 Census			
Age Group	**Male**	**Female**	**Total**
Under 1	747	700	1,447
1-4	2,663	2,435	5,098
5-9	3,723	3,459	7,182
10-14	3,855	3,628	7,483
15-19	3,347	3,088	6,435
20-24	2,128	2,069	4,197
25-29	1,861	1,809	3,670
30-34	1,615	1,552	3,167
35-39	972	919	1,891
40-44	1,390	1,255	2,645
45-49	1,135	935	2,070
50-54	780	621	1,401
55-59	744	611	1,355
60-64	866	916	1,782
65-69	872	924	1,796
70-74	539	492	1,031
75-79	284	255	539
80+	229	273	502
Total	**27,750**	**25,941**	**53,691**

Source: DGE. (2018). *Manufahi em números: Estatística Município de Manufahi 2018*. 6°Edição 2018.Retrieved from: https://www.statistics.gov.tl/wp-content/uploads/2020/03/Manufahi-em-Numeros-2018.pdf (Accessed: 04 February 2021).

6.4.1.1 Land Area

Timor-Leste has a land area of approximately 15,000 km^2 with average population density of 79.7 per km^2. The highest land area by municipality in Timor-Leste is Viqueque and the smallest is Dili (the capital). Population density in Dili is extremely high as compared to other municipalities. This is an indication that many people are migrating into the city to participate in economic activity and schools.

The drilling location of the project encompasses two municipalities namely Ainaro and Manufahi. Rusa-1 well is located at Suco Foho-Ai-Lico, Administrative Post of Hatu-Udo, Ainaro Municipality, and the main camp at Betano, Manufahi Municipality. As indicated in Table 6-32 above, Ainaro has land area about 869.80 km^2 with population density of 73.9 per km^2 and Manufahi has land area of 1,326.60 km^{2}with population density about 42 per km^2.

Administrative Post of Hatu-Udo with land area of 243.01 km^2 occupy about 28% of Ainaro Municipality, as shown in Table 6-35 below. Hatu-Udo has a total number of 2 sucos and 32 Aldeias, as shown in Table 6-36.

Table 6-35. Geographic area of Ainaro and Manufahi by Administrative Post

Municipality	Administrative Post	Sucos	Area km^2	Percentage Area %
Ainaro	Ainaro Villa	Ainaro, Cassa, Manutaci, Mau-Nuno, Mau-Ulo, Soro, Suro-Craic	235.94	27.13
	Hato-Builico	Mauchiga, Mulo, Nuno-Mogue	129.88	14.93
	Hatu-Udo	Foho-Ai-Lico, Leolima	243.01	27.94
	Maubisse	Aituto, Edi, Fatubesi, Horai-Quic, Liurai, Manelobas	260.97	30
TOTAL			**869.80**	**100**
Manufahi	Alas	Aituha, Dotik, Mahaquidan, Taitudac, Uma Berloic	406.96	30.68
	Fatuberliu	Bubussuso, Caicassa,Clacuc, Fahinehan, Fatukahi	375.92	28.34
	Same	Babulo, Betano, Dai-Sua, Grotu, Holarua, Letefoho, Rotuto, Tutuluro.	355.28	26.78
	Turiscai	Aitemua, Beremana, Caimauc,, Fatucalo, Foholau, Lessuata, Liurai, Manumera, Matorec, Mindelo, Orana.	188.44	14.20
TOTAL			**1,326.60**	**100**

Table 6-36. Number of Sucos and Aldeias in Ainaro and Manufahi

Municipio	Posto	Suco	Aldeia
Ainaro	Ainaro Villa	7	32
	Hatu-Udo	2	16
	Hato-Builico	3	21
	Maubisse	9	63
Manufahi	Alas	5	19
	Fatuberliu	5	23
	Same	8	54
	Turiscai	11	39
	TOTAL	50	267

6.4.1.2 Population

Population of Ainaro and Manufahi are two of the lowest in Timor-Leste when compared with other municipalities. The total number of population in Ainaro and Manufahi municipality are 64,615 and 53,691, respectively. A total of 4,939 staying overnight at suco Foho-Ai-Lico (Rusa-1 Well Location) as shown in Table 6-37 below. Among them 52% of are Male and 48% are Female. The proportion of number of population to the number of household indicates on average, Ainaro is 6 people/household and Manufahi is also 6 people/household. When look at the Suco Level for population to household proportion, Suco Foho-Ai-Lico is with the average of 5 people/household.

Table 6-37. General Population demographic of Ainaro and Manufahi Municipality

RUSA-1 WELL LOCATION	NUMBER OF PEOPLE			NUMBER OF HOUSEHOLDS
	Male	Female	Total	
Suco Foho-Ai-Lico	2,586	2,353	4,939	963
Post Administrative Of Hatu-Udo	5,306	4,993	10,627	2,469
Municipality Of Ainaro	33,249	31,366	64,615	10,600
Timor-Leste	607,705	583,873	119,1578	204,596

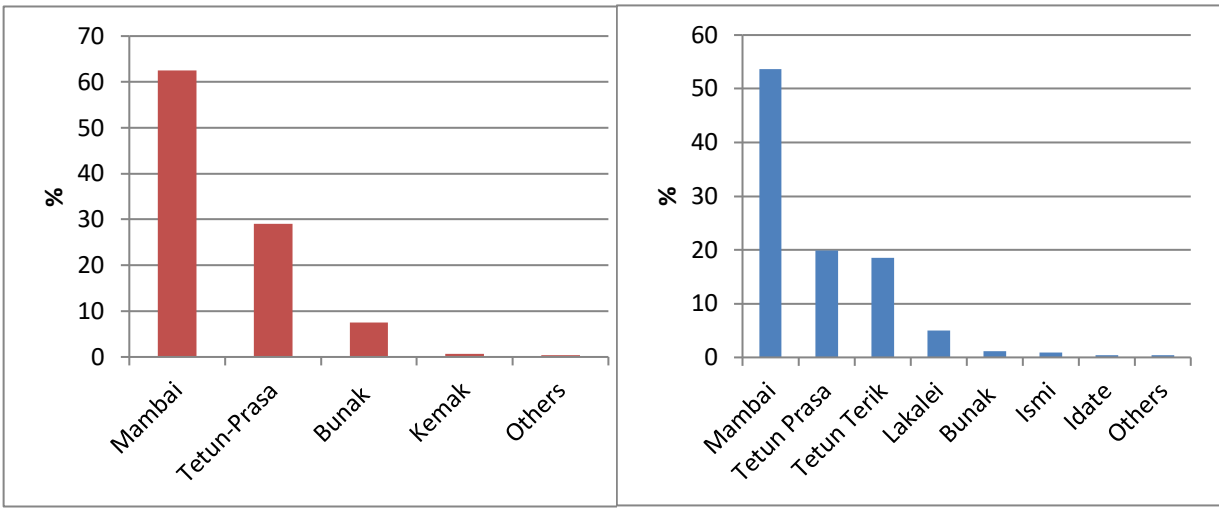
6.4.1.3 Language

Timor-Leste is a small island nation but its populations speak many languages. On average Timorese people speaks two languages or more. Most Timorese speaks their dialects and other dialects. Other national languages have special consideration in the constitutions of Timor-Leste article 13.2, which recognize 16 languages and 32 dialects. The official language in Timor-Leste is Tetum and Portuguese along with English and Indonesian as working language.

There are two major language groups in Timor-Leste, namely Austronesian and Non-Austronesian. Mambae is an example of an Austronesian language which is widely spoken in Ainaro and Manufahi. On the other hand, Makasae which is widely spoken in Baucau and Viqueque is an example of a Non-Austronesian language. A more detailed language spoken in Timor-Leste is summarised in Figure 6-44 below.

Figure 6-44. Languages of Timor-Leste; Source: SIL International (Lewis, 2009).

In Ainaro Muncipality the most spoken language is Mambai and Tetum Prasa (National Language) and small number of population who speaks Bunak, Kemak and others. On the other hand, majority of Populations in Manufahi also speaks Mambai along with Tetum Prasa (National Language) and Tetum Terik as most spoken language. There are also small number of population in Manufahi that speaks Lakalei, Bunak, Ismi and Idate as shown in Figure 6-45 below.



(a) Ainaro (b) Manufahi

Figure 6-45. Percentage of Most Spoken Language in (a) Ainaro and (b) Manufahi

6.4.1.4 Religion

Populations of Timor-Leste are predominantly Roman Catholic with 97.6%, based on 2015 census. There are also other religious groups in the country includes the Protestant Church (2.24%), Islam (0.33%), and Buddhist (0.07%). In Ainaro and Manufahi Municipality the major religion in the area is catholic. Based on the survey (Socio-economic team, 2020) in the Suco Foho-Ai-Lico and surrounding most of the people are catholic and there are some small number of protestant and Islam.

6.4.1.5 Education and Literacy

Education in Timor-Leste has faced many challenges over the years since independence in 2002. The government with its development partners has invested a great amount of efforts and resources to make education in Timor-Leste as it is today. The overall education profile of Timor-Leste is as indicated in Table 6-38 Table 6-39 Table 6-40 and Table 6-41 .

Table 6-38. Total number of students by level of education and sex, Timor-Leste 2015

	Male		Female		Total		Sex ratio (M/F)
	Numbers	Percentage	Numbers	Percentage	Numbers	Percentage	
Pre-Primary	10,826	5.0%	10,440	5.2%	21,266	5.1%	103.7
Primary	112,233	51.4%	101,353	50.4%	213,586	50.9%	110.7
Pre-Secondary	38,915	17.8%	39,067	19.4%	77,982	18.6%	99.6
Secondary	31,652	14.5%	29,487	14.7%	61,139	14.6%	107.3
Polytechnic /	998	0.5%	762	0.4%	1,760	0.4%	131.0
University	20,037	9.2%	16,598	8.3%	36,635	8.7%	120.7
Non formal	1,011	0.5%	1,236	0.6%	2,247	0.5%	81.8
Undetermined	2,540	1.2%	2,150	1.1%	4,690	1.1%	118.1
Total	218,212	100.0%	201,093	100.0%	419,305	100.0%	108.5

The appropriate age for primary school is 5-12 years old, pre-secondary is 13-15, secondary and vocational polytechnic is 16-18, and University is 18 years old above. Among boys and girls in Timor-Leste there exists a gender gap in education participations. The highest gender gap is at university level where 120.7 sex ratio with 20,037 male and 16,598 female. Furthermore, sex ratio in lower level of school such as pre-primary (103.7), primary (110.7), pre-secondary (99.6) and secondary (107.3) indicated that almost the same sex gap in education participation as in the university.

Table 6-39. Education profile at Municipal Level, Ainaro and Manufahi

Education Level	Municipality					
	Ainaro			Manufahi		
	Number of Students	Number of Teachers	Number of Schools	Number of Students	Number of Teachers	Number of Schools
Pre-Primary	878	34	18	1485	79	38
Primary and Pre-Secondary	17737	774	82	15743	599	76
Secondary School	2298	53	6	2597	100	6
Polytechnic	485	18	3	847	57	4
TOTAL	**21398**	**879**	**109**	**20672**	**835**	**124**

In Municipal level, school infrastructures are as presented in the table above. There are a total of 109 schools in Ainaro and 835 schools located throughout the municipality. Looking at the number of students in both municipality, the highest number of students are in primary and pre-secondary, 17,737 (82.9%) in Ainaro and 15,743 (76.2%) in Manufahi. The average numbers of students in schools are 48 students/school in pre-primary, 216 students/school in primary and pre-secondary, 383 students/school in secondary and 162 students/school in Polytechnic.

Table 6-40. School attendance Status of Population in Suco Foho-Ai-Lico

RUSA-1 WELL LOCATION	SCHOOL ATTENDANCE				TOTAL POPULATION
	At School	Left School	Never Attended School	Don't Know	
Suco Foho-Ai-Lico	1,715	1,301	1,277	80	4,373
Post Adm. Hatu-Udo	3,789	2,623	2,528	135	9,075

In Suco Foho-Ai-Lico (Rusa-1 Well Location) there are 1,277 (29.2%) of populations never attended a formal education and 1,301 of population (29.8%) left school. Collectively, out of 4,373 populations the numbers indicated there are 59% of people never attended school and have left schools compare to population that attending schools (39.2%). This statistics is an indication that many people in grass roots are not attending formal education.

Table 6-41. Level of Education in Suco Foho-Ai-Lico

RUSA-1 WELL LOCATION	LEVEL OF EDUCATION							TOTAL
	Pre-Primary	Primary	Pre-Secondary	Secondary	Diploma	University	Non Formal	
Suco Foho-Ai-Lico	208	1,541	588	560	18	69	32	3,016
Post Adm. Hatu-Udo	394	3,005	1,401	1,240	45	201	126	6,412

In Suco Foho-Ai-Lico, out of 3,016 students, 208 (6.9%) in pre-primary, 1,541 (51.1%) in primary school, 588 (19.5%) in pre-secondary, 560 (18.6%) in secondary, 18 (0.6%) in Polytechnic/Diploma, 69 (2.3%) in University and 32 (1.1%) are in non-formal education.

This indicates that the number of students 5 years old and above who attended school are mostly in pre-primary and primary school age 5-12 years old.

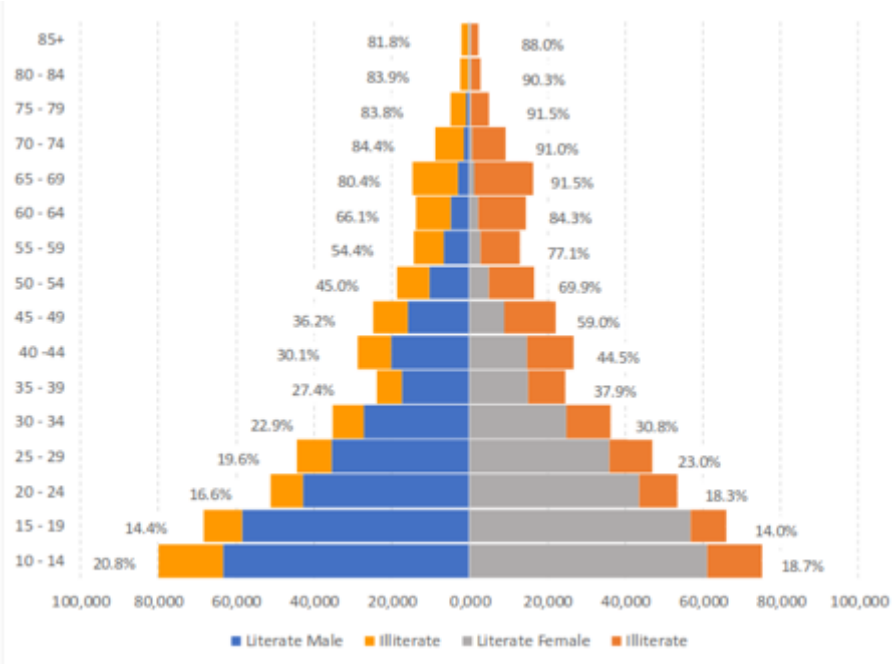


Figure 6-46. Populations of 10 years old and above by literacy status and sex.
Source: Timor-Leste population and housing census 2015, Analytical report on Education profile (2017).

The pyramid in Figure 6-46 indicated a very high illiteracy level in Timor-Leste. The illiteracy is shown on man and women 45 years old and above. In the five year age group indicated in the pyramid there are higher number of female illiteracy than male. More than half of men 55 years old above and women 45 years old above are illiterate. When looking closely to the age group of 65-69 years old, more than 90% of women and 80% of men are illiterate and unable to write or read any of the four working language used in Timor-Leste.

6.4.1.6 Livelihood and Poverty

Damage to infrastructure and the dislocation of the population during the independence struggle 1999 and the holocaust 2006 made Timor-Leste's poverty problem become worse. Local studies indicate that a higher proportion of the rural population are poor, compared to the urban areas. About 75% of the poor live in rural areas and 25% live in urban areas. Limited alternative sources of income have resulted in increasing numbers of poor people in rural areas. High population growth (around 3% per year) rapid urbanization and small formal sectors have resulted in slow employment creation rates in urban areas and have contributed to rising poverty levels.

The poverty incidence in the affected area is high. All household have access to electrical power from the national transmission grid. Drinking water is provided from distribution pipe and local wells.

More recent analysis of Timor-Leste poverty by the ADB utilizing both the 2007 poverty study and the 2009 Living Standards Assessment concluded that along with the expansion of the economy, incidence of poverty has decreased, however, living standards improvement and inclusive growth should continue to be pursued through increase in access to basic infrastructure and improvement in education and health care systems.

A survey conducted by Timor Resources through socio-economic team to the representative community on indirectly affected households highlighted the following characteristics of employment for community located within and surrounding project site (see for example Table 6-42).

Table 6-42. Livelihood of Households Indirectly Potentially Affected by the Project
Source: (Socio-economic survey, 2020)

Livelihood	Foho-Ai-Lico
Main Livelihood	
Farmer	16
Official Servant	
Teacher	
Kiosk Owner	2
Fishermen	1
Additional Livelihood	
Breeder	11
Rice Field	6
Raising Chicken	1

Most of the population in Foho-Ai-Lico are farmers as indicated above. Agriculture is the main source of income by the local community, which is then sold back to consumers as their income. Additional income for people come from animal breeding and seasonal working in rice paddies twice a year.

6.4.2 Health Profiles of Communities

The National Directorate of Statistics, under the Ministry of Finance conducted a Demographic and Health Survey (DHS) in 2003 and 2009. Several indicators are being used to paint the profile of community health, namely; Infant and child mortality, Maternal mortality, Child health, Nutrition of children, and Malaria. Because no data are available for suco or even post administrative level, national data are being used paying particular attention to rural data.

6.4.2.1 Infant and child

There has been a substantial improvement in Timor-Leste's child survival rate. The decline in the neonatal, post neonatal, infant, child and under-5 mortality rates as reported in DHS 2009 indicated clearly that Timor-Leste is on track to reach the target for Millennium Development Goal (MDG) 4, which is to reduce under- 5 mortality by two thirds by 2015.

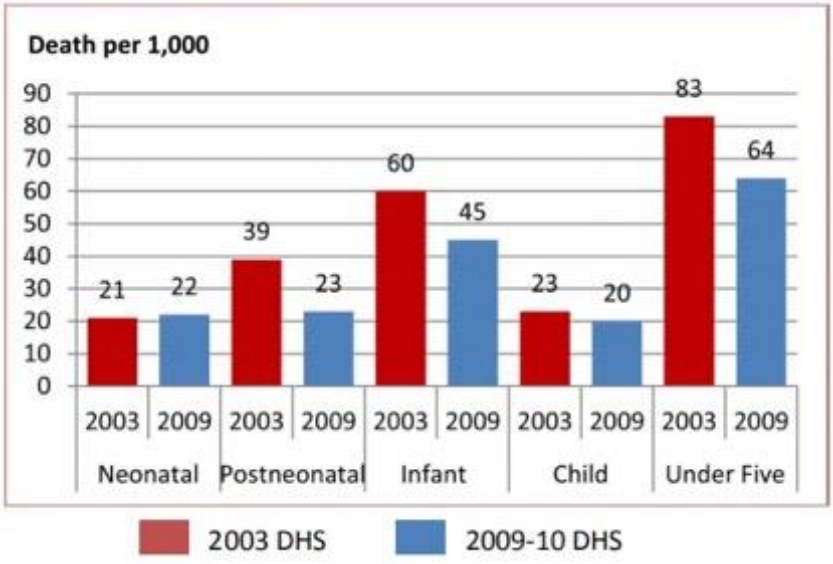


Figure 6-47. Mortality rate of Child and babies under 5 years old.

6.4.2.2 Maternal mortality

As documented by DHS 2009, Maternal Mortality Rate (MMR) in Timor-Leste remains one of the highest in the world. Direct estimates of maternal mortality for the period 0-6 years prior to survey in 2009/2010 are reported in Table 6-43.

Table 6-43. Estimates of maternal mortality (DHS, 2009)

Age	Maternal Deaths	Exposure Years	Mortality Rate[1]	Proportion of Maternal Deaths to Female Deaths
15 - 19	8	26,996	0.286	20.2
20 – 24	22	26,051	0.826	43.3
25 – 29	24	20,387	1.198	48.2
30 – 34	32	17,247	1.842	46.4
35 – 39	12	14,917	0.836	45.2
40 – 44	15	10,412	1.439	45.5
45 - 49	6	5,917	1.026	33.5
Total	120	121,927	0.960	41.7
General fertility rate (GFR)	0.172[3]			
Maternal mortality ratio (MMR)[2]	557			

6.4.2.3 Child health

Combined with data on child mortality, information on child health depicts children as a vulnerable sub-group in the community. Children's health remains a great concern for both urban and rural children in Timor-Leste, as shown in Table 6-44. Of particular concern is the high rate of nonvaccination to children in rural area (25%).

Table 6-44. Health indicators for children in urban and rural areas (DHS, 2009)

Type	Health Indicator	Urban	Rural
Children's weight and size at birth	% of all live births found to be very small or smaller than average at birth	15.2%	15.7%
Vaccination	% of children age 12 -23 months who have received no vaccination at any time before the survey.	14.5%	25.3%
Prevalence of Acute Respiratory Infections (ARI)	% of children < 5 y.o who had ARI in the 2 weeks preceding the survey	2.8%	1.8%
Prevalence of fever	% of children < 5 y.o. who had fever in the 2 weeks preceding the survey	24.1%	17.6%
Prevalence of diarrhoea	% of children < 5 y.o.who had diarrhoea in the 2 weeks preceding the survey	18.9%	14.5%

DHS data from 2003 and 2009 indicate that there has been a slight increase in the level of stunting (height for age), wasting (weight for height) and underweight among children. Stunting increased from 49 to 53%, wasting increased from 12 to 17%, while underweight is reported to have increased from 46 to 52%. Additionally, malnutrition was reported to remain high in general with the proportion of children who have chronic malnutrition increased between 54 to 58%.

6.4.2.4 Malaria

Malaria remains a leading public health problem in Timor-Leste with 80% of the cases concentrated especially to only 4 of the 13 municipality in the country – Dili, Viqueque, Covalima and Lautem. As reported in DHS 2009, the number of confirmed cases of malaria has risen three folds between the year 2000 and 2008, however, caution should be taken as some of the increase could be due to a case of better diagnostic capacity, monitoring and surveillance on the field

6.4.3 Institutions, Schools and Health Facilities

Around the project there are several schools (EBF Sesurai and EBF. Raemelau), health clinic and health center and also have Grupo Agrikultor Hupi, Hamahon Feto Timor (HAFOTI), Asosiasaun Agrikultor Raikotu. The nearest health clinic is located in Dai Sua village (about 3.5 km) and in Ailora village, from project boundary to health clinic is available every day (7/24) if have any emergency (birth, foetal) is only providing primary health care with no capability to treat major accidental injuries. The heath centre near the project area is located in Same, Manufahi Municipality. Some of the closed institutions is the Instituto Politecnico de Betano (IPB).

School and health infrastructure in Suco Foho-Ai-Lico, is shown in Figure 6-48 .

Instituto Politecnico de Betano

EBF. Raemerlau

EBF. Sesurai

Health clinic in Dai-Sua

Figure 6-48. School and Health Infrastructure in Suco Foho-Ai-Lico, Hatu-Udo, Ainaro

6.4.4 Community and Family Structures

Generally in Timor-Leste households are headed by males (DHS, 2020). In Foho-Ai-Lico households are led by males, based on the survey socio-economic and directly to the community surrounding project boundary reported that they are married while the rest are considered minor, divorced/separated or widowed (see for example Table 6-45 and Table 6-46).

There are a total of 16 households' respondent that representing the indirect and direct impact from the project activities, the majority of the surveyed are nuclear family households consisting of parents and children. Maximum household members are found to be 12 and the minimum household member is 2.

Table 6-45. Socio-economic survey of the community in Foho-Ai-Lico

No	Name	Main Livelihood	*Xefe da Familia* (household chief) by gender (male/female)	Total number of families
1	Aleixo da Costa	Farmer	Male	5
2	Aleixo Gonzaga	Farmer	Male	4
3	Rozalino Nunes	Farmer	Male	5
4	Acacio da Costa	Kios owner and Farmer	Male	6
5	Jaime Soares	Farmer	Male	5
6	Joaozinho Seqera	Farmer	Male	3
7	Lucio da Costa	Farmer and Fishermen	Male	6
8	Sebastiao de Araoju	Farmer	Male	6
9	Sebastiao C. Magno	Farmer	Male	8
10	Aleixo Corte Real	Farmer	Male	6
11	Ismail Masugi	Farmer	Male	2
12	Sonio F. Sarmento	Farmer and Kios owner	Male	4
13	Umar Ali	Farmer	Male	12
14	Daniel Pereira	Farmer	Male	6
15	Paul da Costa	Farmer	Male	5
16	Angelino Noronha	Farmer	Male	8

Table 6-46. Survey to the some community that will potentially be affected by the project activities

No	Indirectly households affected	Main Livelihood	Total number of families
1	H1	Farmer	8
2	H2	Farmer	4
3	H3	Farmer	4
4	H4	Fishermen and Farmer	7
5	H5	Farmer	8
6	H6	Farmer	3
7	H7	Farmer	7
8	H8	Farmer	9
9	H9	Farmer	11
10	H10	Teacher and Farmer	9
11	H11	Farmer	5
12	H12	Farmer and Driver	6
13	H13	Farmer	5
14	H14	Farmer and Fishermen	8
15	H15	Farmer	14
16	H16	Farmer	5
17	H17	Official servant	10
18	H18	Farmer	5
19	H19	Farmer	4
20	H20	Farmer	11
21	H21	Kios owner and Farmer	7
22	H22	Farmer	9
23	H23	Farmer	7
24	H24	Farmer	7

6.4.5 Land ownership
(Including informal or customary land ownership, and any other rights over the land)

According to the DGTPSC, Ministry of Justice, the land plots included in the project area are private land. Most of the land in Foho-Ai-Lico is private land, but the school land and in part those close to the beach belong to the Government.

6.4.6 Any Types or Common Individual Rights on Natural Resources

Communities in direct and indirect area of influence of the project are heavily reliant on the agricultural, some of them are fishermen but only additional. Understanding common and individual rights to natural resources is important in predicting potential impacts from diverting the use of certain resources in a community.

6.5 CULTURAL COMPONENTS

6.5.1 Cultural Heritage and Sacred Sites

UNESCO defines the types of cultural heritage, first the 'tangible' and second 'intangible.' The Tangible cultural heritage refers to materials, artifacts, monuments, buildings and sites that are the physical manifestations of a group or society's culture. Intangible cultural heritage refers to "*the practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artifacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their cultural heritage*" (UNESCO 2012). The cultural components for this specific study, the overall aspects of the cultural heritage both tangible and intangible were not evaluated thoroughly within the areas of interest.

Customary cultures in Ainaro and Manufahi are permeated with intangible cultural heritage where the local communities celebrate their cultural ceremony or conduct local ritual at the site such as marriage; death; birth; harvest of agricultural products, which is commonly for rice and corns production and harvesting; where dry season for longer period then the community will perform a ritual by the elders where they belief that the ritual could potentially increase the probability of rainy seasons. Thus, with the purpose of the ritual and belief, the community has a confidence that they have asked the permission from the sacred land and sites thus the activity of the project can be continued and developed as planned.

6.5.2 Archaeological Site

There are no archeological or anthropological sites identified during the EIA survey in the field within the study area or to be found or to take place within the well site location.

6.5.3 Historical Site

There are no major historical sites observed during survey within the identified surveyed areas. There, however general historical sites outside the study areas such as Dom Boaventura statue, it was a historical site of the kingdom and the King of Boaventura.

6.5.4 Sacred Sites

Sacred places are defined as places valued and respected by local communities through unwritten norms; however, it is valid only in some developed society where they define behavior patterns and give rights and obligations to members of the community or a line of family (Ministry of Tourism 2021).

There is one sacred site approximately 0.2 km from the Rusa-1 location called Nakabelis. Nakabelis sacred site from Uma Lisan Aisabe Toko, this sacred house has been practicing several traditional skills to enhance and innovate their way of living. Moreover, the use of modern technology and essential expertise for conservation with the use of sustainable resources of forestry and animal provides socio-economic values. This practices happens almost every year in both Ainaro and Manufahi, the aforementioned practices performed by the *uma lisans* for instance the ceremony of *sau batar* during corn harvesting season and farming time where surface water is diverted from the river into the agricultural irrigation system for farming purposes.

6.5.5 Unique Landscape

There is no unique landscape protected or conserved either by local community or at state level near the Rusa-1 location.

7 CLIMATE CHANGE

This section describes relevant climate change to the drilling operations and decommissioning of the drilling platform. All relevant data and information on climate in this section are secondary sources and mostly taken from the national adaptation program of action on climate change (NAPA) adopted in 2010.

7.1 OBSERVATION AND HISTORICAL WEATHER TRENDS

Meteorological data was provided from an Automated Weather Station (AWS) owned by the Ministry of Agriculture within the Suai study area. The data spans from 2008 to 2014 calendar years for the following parameters:

- Maximum and minimum air temperature (degree Celsius)
- Relative Humidity (%)
- Evaporation (mm)
- Wind speed (m/s)
- Rainfall (mm)

The supplied data are on daily recorded basis and does not have report on wind direction. A typical meteorological AWS shall make an hourly basis observation. In addition to this lack of information, there are significant gaps between months and years over the reported period. As such data does not provide sufficient time-dependent resolution to adequately assess the current trends of climate change.

According to NAPA there is no national country-specific studies and insufficient historical data for Timor-Leste to provide comprehensive analysis and evidence of how its climate has changed. A number of preliminary studies, including analysis of data from West Timor, can be used to provide indication of possible changes in climate in the region, and in addition, global models are also used to extrapolate information to Timor-Leste level. IPCC global models indicate that in South-East Asia extreme weather events associated with El-Niño have been both increasing in frequency and intensity in the past 20 years. This has had an impact on Timor-Leste climate patterns with estimated decreases in mean rainfall indexes, in particular for the dry season and increased incidences of extreme weather events.

7.2 FUTURE PROJECTIONS UNDER PROJECTED CLIMATE CHANGE

There are number of models used to provide various projections of climate change in Timor-Leste. Those climate change projections, however do not represent a value specific to any actual location of a town or village in the country; it instead portrays the average change over the broad geographic region within the country and the surrounding oceans.

7.2.1 Temperature

The temperature projection indicates Timor-Leste will experience increasing of annual average air temperature and sea-surface temperature in the future according to emission projection scenarios, which are analysed for 30 interval years started from 2020, 2050 and 2080 and changes were calculated relative to the reference period 1961 – 1990. The increases of temperature for the years mentioned is in order of 0.8 ºC, 0.5 ºC and 2.2 ºC respectively.

Extreme temperature events are also expected to increase, i.e. by 2050, a 7-day or 30-day heat wave event can be expected to increase by up to 2.3 ºC and that length of such event can be expected to increase by two days. See for example AK-2010.

7.2.2 Rainfall

Rainfall is also expected to increase in relation to the reference period 1961 – 1990, by 2%, 4% and 6% by 2020, 2050 and 2080 respectively. This overall rainfall projections, though is different from the current rainfall projection for Indonesia, but showing similar rainfall increase trends to northern part of Australia. According to NAPA, these differences in the rainfall projection trends may have been due to a poor resolution of the current model used; and hence this data analysis may need to be considered wise perspective. See for example Barnett et al. 2007.

In addition to an expected overall increase in rainfall for Timor-Leste, extreme rainfall event are expected to increase across the different monthly period. Overall the rainfall events are expected to become less frequent but more intense.

7.2.3 Sea level rise and ocean acidification

NAPA (2010) indicates that the sea level rise in Timor-Leste is expected to be the same as global averages with variations of only minus 0 – 1 cm. However, it should be taken into considerations that Timor-Leste is estimated to have an annual uplift of 1cm given the tectonic activity. The following Table 7-1 below shows the projection of sea level rise relative to 1990 reference period data:

Table 7-1. Projection of the sea level rise

Projected year	Sea level rise(cm)
2020	3.2 – 10 cm
2050	8.9 – 27.8 cm
2095	18 – 79 cm

NAPA further denotes that there is possibility of sea level rise larger than 0.5 – 1.0 m range by 2100 relative to the 1990 reference period data. Though, this projection cannot be ruled out for there is a considerable of uncertainty within the estimation of future sea level rise, nearly the uncertainties indicate that the corrections could be for higher rather than lower estimates.

It is also expected that given an increase in absorption of Carbon Dioxide (CO_2), the sea water pH level in Timor-Leste will decrease and lead to ocean acidification, which would have impact on marine ecosystem. the projection scenario indicates that by 2070s relative to 1990 reference period data, the ocean pH level would decrease by -0.16 – 0.17.

7.3 CLIMATE IMPLICATIONS OF THE PROPOSED PROJECT OR THE ENVIRONMENT

Implications of climate change on the project are summarised in Table 7-2 .

Table 7-2. Implication of climate change on the proposed project or environment

Climate impact Source	Impact projection analysis	Potential factor impacted	Implications on project or environment
Temperature	- Changes to ambient temperature - Increase evaporation - Increase humidity	- Ground and surface water - Flora and fauna - Forest ecosystem - community health - Agriculture	- Potential impacts on human health due to increasing temperature, such as dehydration, easily fatigue - Potentially increase in energy consumption due to increasing of cooling system - Drought affects the soil fertility for farming
Rainfall	- Changes to rainfall patterns with increased or decreased rainfall - Increase in extreme rainfall events e.g. cyclones - Changes to flow and flooding regimes of rivers and drainages	- Ground and surface water - Flora and fauna - Forest ecosystem - community health - infrastructure	- Potential impacts to infrastructure and accommodation from flooding and cyclones - Affects the productivity due to extreme weather delays (e.g. road travelling, pre-drilling and drilling activity) - Impacts to the post-closure land use and decrease in success of rehabilitation due to a drying climate
Sea Level rise	- Inundation of lower lying areas - Changes to flow and flooding regimes of rivers and drainages - Saltwater intrusion of aquifers	- Ground water - Marine ecosystem - Marine flora and fauna - Soil	- Impacts to the coastal resources - inaccessible or unsafe - Impacts to the water supply with increased salinity due to intrusion - Impacts to long term land use and decrease in success of soil rehabilitation

7.4 CLIMATE CHANGE ADAPTATION MEASURES

For climate change impacts NAPA identifies vulnerable sectors, which are needed to be prioritized for climate adaptation or mitigation measures. These include, food security, water availability, ecosystem, human health, human settlement and infrastructure and disaster management. Therefore, for any project related mitigation measures proposed in this EIS and EMP shall reflect these priorities in addressing the climate change related impacts. The propose adaptation or mitigation measures are listed out in Table 7-3, detailed discussion of mitigation measures are addressed in Section 9.4.

Table 7-3. Climate change adaptation measures or proposed mitigations

Drilling Phase (after Section 4.1)	Potential impact aspect	Adaptation measures or proposed mitigations (See Section 9.4 for details description of mitigation measures)
Predrilling; drilling; Suspension and Abandonment	Surface water	Propose mitigations for impacts related to drainage, as follows: - Cleaning of all oil, fuel and waste spills immediately - Waste management procedure to control litter - Mitigation of sedimentation of the culverts and on site drainage by means of an active drainage maintenance program. - Mitigation of flooding during extreme runoff events through the use of berms and diversion drains to limit flooding of the construction site.
Predrilling; drilling; Suspension and Abandonment	Ground water	Propose mitigation measures recommended for impacts to water supply described below: - Cleaning of all oil, fuel and waste spills immediately - Waste management procedure to control litter - Mitigation of sedimentation of the culverts and on site drainage by means of an active drainage maintenance program. - Mitigation of flooding during extreme runoff events through the use of berms and diversion drains to limit flooding of the construction site.
Predrilling; drilling; Suspension and Abandonment	Forest	Propose mitigation measures would be: - Develop Rehabilitation Plan for forest ecosystem conservation
Predrilling; drilling; Suspension and Abandonment	Terrestrial Flora and Fauna	Propose mitigation measures for impacts to terrestrial ecology described below: - Selection of the site to limit impact on habitat with the site selected having the lowest possible clearing footprint of all the configuration options. - Reduction in dust and noise generated through the implementation of a Dust and Noise Management Plan including wetting of unsealed roads, limiting dust generating activities when it is windy and monitoring of dust and noise levels in the project area and/or in the sensitive receptors locations.
Predrilling; drilling; Suspension and Abandonment	Air quality	Propose mitigation measures include: - Develop and Maintenance of the Grievance Redress Mechanism established prior pre-construction and expansion to include construction impacted stakeholders - Carry out periodical air quality survey at the sensitive receptors location - Carry out health screening for workers, especially those work directly under any dusty work environment
Predrilling; drilling; Suspension and Abandonment	Community health	Propose mitigation measures would be: - Workers should be provided with adequate shade, water and appropriate clothing including wide-brimmed hats and long-sleeves. - Workers should be closely monitored for symptoms of heat sickness and dehydration. - During extreme heat events, working hours should be adjusted to avoid the hottest parts of the day. - Develop and Maintenance of the Grievance Redress Mechanism established prior pre-construction and expansion to include construction impacted stakeholders - Facilitate education and awareness programs throughout the lifespan of the platform - Establish access controls to the site activities posing health and safety risks to the community. - Develop strict protocols for increased traffic safety.

8 ALTERNATIVES

As specified in Ministerial Diploma No. 46/2017 a brief description of the realistic alternatives for the project are described here.

In the first case, the only known means of testing for the presence hydrocarbons in a subsurface accumulation is by a physical intersection by the means of drilling an Exploration Well. Therefore, there is no alternative to drilling operations. Drilling is a minimum work requirement to fulfil the obligation of the PSC.

Viable alternatives that can be considered are often limited because of technical requirements for the drilling program, typically the need to locate a well above or near the target hydrocarbon reservoir, the requirement to use specific types of equipment (e.g. drilling rig specification), materials (e.g. drilling fluids) and techniques based on the subsurface geology, and the requirement to select and schedule the drill rig in advance.

Analysis of alternatives for the project are simple, either **"No Project" Alternative**, that is, don't drill at all, or proceed after considering alternative methodologies, as described below, and assessment of potential impacts and identification appropriate mitigation, as required.

8.1 "NO PROJECT" ALTERNATIVE

"**No Project" Alternative**: would mean that no drilling would be performed in this PSC which would preclude any possible future contribution to the growth of Timor-Leste's economy. The country will have fewer opportunities for oil/gas supply to the domestic market and for export and less economic growth. It could lead to less employment and secondary business opportunities.

The oil and gas sector accounts for 36% of the country's GDP, 98% of exports and 41% of total imports in 2017. However, production has been decreasing since 2012 and continues to decline, with a year-on-year fall in production in 2017 of 15 percent. Petroleum production levels in 2012 averaged 202,500 barrels of oil equivalent per day (BOE/d), but in 2017 production was down to 114,000 BOE/d and by 2019 to 104,000 BOE/d.

Whilst the government continues efforts to diversify the economy, the ongoing development of the oil and gas sector is seen as one of the pillars of future economic development. The award of the TL-OT-17-09 PSC to Timor Resources is seen as a crucial step for the future, since the area has been considered highly prospective for many years. The exploration activities are welcomed by the Government and any significant oil discovery could provide a long-awaited windfall for the benefit of the nation. The project therefore will potentially play an important part in the country's future development, particularly in the Manufahi area. Major benefits from a successful exploration drilling project could include increased employment opportunities for local communities both direct and indirect, improvement in livelihood of the communities, and increased revenue for the area.

Exploration drilling, following on from the seismic survey conducted in 2019, is a necessary next step to a potential discovery and development of a commercial hydrocarbon reserve. The project activities may potentially cause impacts to the local communities and the surrounding environment however, these are expected to be limited in space and time and will be eliminated

or minimised in through the EMP. The "No project" option precludes the proving of any prospects identified in the seismic survey.

The "No Project" alternative for this project is not being considered further.

8.2 WELL LOCATION

Once drilling was accepted as the only means of evaluating the hydrocarbon potential of the subsurface targets identified, alternative methods and locations of drilling were reviewed (Timor Resources 2021b). The impact on delivering a technically successful operation were assessed in terms of successful subsurface intersection, degree of drilling difficulty and risk of hole problems, and incremental cost to the base condition.

The area surrounding the optimal well location was analysed to assess the impact on the environment, community, and cost of the various alternatives. These considerations are not mutually exclusive so have been considered in terms of a risk assessment based on the location of alternatives within the viable proximity of the optimal location.

As mentioned, viable alternative locations that can be considered are often limited because of technical requirements for the drilling program, typically the need to locate a well above or near the target hydrocarbon reservoir. Therefore, the options for the well site are constrained to within a few hundred metres depending on the subsurface targets.

The decision to drill vertical boreholes was made and approved early in the PSC TL-OT-17-08 program in order to avoid unnecessary operational risk and reduce cost, and hence, the rig specification was selected accordingly. The PSC TL-OT-17-09 program follows directly on from the PSC TL-OT-17-08 program, "back-to-back" and the rig is again only capable of meeting the straight, vertical borehole requirements, thus limiting the choice of the surface location. The surface location selection is a function of reaching the optimum bottom hole target and considering any sensitive issues at the surface location.

For the Rusa-1 location, full consideration has been given to geological, environmental, social, cultural and economic issues (Timor Resources 2021b).

8.2.1 Directional v Vertical Boreholes

Discussions on Vertical versus Directional Drilling were considered during the project design and preparation and it should be noted that vertical, straight hole option was selected and approved by the authorities. It was concluded in the PSC TL-OT-17-08 Terms of Reference (TOR) that directional drilling would have required further consideration, not only cost but because the technology introduces additional operational risk. Thus, there was an early decision to opt for vertical, straight holes on safety and cost grounds, however, for completeness the following provides a short description of the two alternatives.

8.2.2 Vertical Drilling

A vertical well is a borehole that is aimed at a target directly beneath it. A vertical well does naturally deviate during drilling but is designed to intersect within an allowable radius from the vertical target point vertical drilling is considered a conventional method of oil and gas extraction. Vertical wells differ from directional wells, such as inclined or horizontal wells, because they do not require the use of directional drilling or steering of the trajectory of the drill

Bit. This makes them less expensive to drill and develop. Moreover, vertical wells have traditionally been employed in the exploration phase of drilling where the primary objective is to establish the presence of oil or gas. Vertical wells are less prone to hole cleaning problems, sticking of drill pipe and bottom hole assembly and have a less complex requirement for evaluation (e.g., Wireline logging versus LWD or pipe conveyed shuttle).

Historically, natural gas and oil exploration involved the use of vertical wells because directional drilling technology was expensive and complicated. Whilst the drilling is intended to be vertical the rig will have the capability to side track the hole if required.

8.2.3 Directional Drilling

Directional drilling is a drilling technique in which a well is bored at multiple angles. Directional drilling most often refers to drilling at non-vertical angles, including horizontally. Because a detailed knowledge of the subsurface structure is required to take advantage of the commercial benefits of directional drilling it is usually employed in the appraisal or development stages.

Directional drilling also allows access to areas where a vertical approach would not be possible, such as deposits that are below a body of water, or underneath a community or with difficult surface topography. Directional drilling can be more efficient and cause less surface disturbance of the environment but requires longer planning and early selection of specialised equipment.
The decision to drill vertical boreholes lead directly to the selection of fit for purpose drilling equipment in terms of rig specification and capacity, the selected rig does not have the capacity to undertake directional drilling. Despite this, consideration was given to alternate well locations that would have required deviated drilling technology, but these were all deemed unfavourable options in the well location review (Timor Resources 2021b).

8.3 Water Consumption

Water consumption during the drilling campaign will be considered under the following categories:

- Potable (Drinking water) – conforming to health standards
- Drilling fluid water – analysed and consistent physical and chemical properties
- General use (e.g. cleaning, dust suppression)
- Supply – reliability, drawdown of existing supply, effect on community supply

Water supply options include local commercial suppliers and accessing the Caraulun River. The requirements and sources are assessed below.

There are two stages in regard to water supply for the drilling project, an initial requirement to fill all storage at the well site, approximately 50,000 L, this is a one-off event. The second requirement is for fresh water of approximately 10,000 L - 20,000 L per day depending on the operation.

Same is one of the places in Timor-Leste with an abundance of water all year-round. JICA built a 20 km long water pipeline in the Same area. Consequently, many in the local community receive their water from this source, rather than commercial suppliers. It is therefore considered the preferred option not to use the Same community supply, but rather to use a number of local

water suppliers in Same capable of supplying water volumes required, and the level of offtake is such that it is not detrimental to the supply for other users over such a short period required for the program which is 40 days.

With regard to the initial 50,000 L requirement, Timor Resources intends to take this from the Caraulun River during rig mobilisation.

The Betano camp already sources its water from a water well.

8.4 POWER SUPPLY

There is no immediate source of mains power supply at the Rusa-1 well location, it would be necessary to construct a powerline from the nearest transformer sub-station to the rig. Despite the proximity of a 150 kv powerline close to the rig site, connection to this would require costly installation of stepdown transformer. Neither options are viable for a short term transient operation.

During the 2019 geophysical operations the stability and security of supply was unstable, it was observed that the local power grid has fluctuations in voltage and frequency that exceed the capacity of the sensitive electrical equipment that will be employed and would necessitate the installation of significant modulation equipment.

Given that there is no other source of power and the short time period, a 40 day drilling program, the rig will employ its own power generation, principally for safety reasons as a secure stable power supply is necessary during drilling operations. The rig power supply will be by diesel generators.

The main accommodation camp at Betano will utilise the mains supply to limit emissions however, an emergency diesel generator will be located at the camp.

8.5 WASTE MANAGEMENT

8.5.1 Cuttings Disposal

Options for the disposal of drilled cuttings may include dewatering, encapsulation and burial in situ in the onsite mud pit; landspreading; landfill; or injection into the annular space of a well if the well is to be plugged and abandoned (IFC 2007b).

8.5.1.1 Dewatering and Encapsulation

Due to its simplicity, burial of wastes in small pits at drilling sites has been a standard means of cuttings waste disposal in the industry. However, with current awareness of pollutant migration pathways, the risks associated with open burial of wastes should be carefully considered. The preferred disposal option is to encapsulate and bury the dewatered cuttings in situ in the onsite pit, sealed with HDPE liner and covered with a minimum 1m of consolidated soil, this represents an environmental intensity of none.

8.5.1.2 Landspreading

Landspreading may be considered as an alternate to encapsulation for drilling fluids and cuttings with low levels of hydrocarbons and salts, provided suitable open, flat land areas are available close to the well site. The process involves the controlled and repeated application of cuttings on a soil surface with the area being periodically tilled to provide the necessary mixing with native soil and to aid oxygen transfer. Active landspreading may include the addition of water, nutrients and other materials to enhance the soil quality.

The characterisation and treatability of the cuttings should be assessed to determine whether landspreading may be effectively implemented. Site topography and hydrology, and the physical and chemical composition of the waste and resultant waste/soil mixture should be assessed, with salts most frequently limiting the application rate. Further the availability of land and the impact of changing land use should also be considered.

If landspreading is taken as the best option then monitoring should be conducted after landspreading to measure progress and determine whether there is a need for soil enhancement, e.g. fertiliser applications.

8.5.1.3 Landfill

Landfills are generally specially constructed and monitored facilities designed to accommodate burial of large volumes of wastes. There is an option to use landfill and burial for inert, non-hazardous and non-toxic wastes in remote areas. However, some landfills may become little more than open dumps, and great care must be exercised to understand future liabilities in their design, operation and eventual closure.

Basic design considerations for any landfill should include, as a minimum, an impermeable lining to contain the landfill contents, there are no suitable facilities in the area.

As discussed above, the mud pit is lined with impermeable HDPE liners, hence are good candidates for use as a landfill after the rig has moved offsite.

The final disposal of cuttings and other waste are detailed in the project Waste Management Plan which will included in the Environmental Management Plan (EMP).

8.5.1.4 Annular disposal

Annular injection is a disposal method where pumpable wastes (usually mud pit fluids) are injected into the surface casing or production casing annulus (or other casing or casing annulus). However, this practice should be managed so that the wastes do not enter underground sources of water.

Annular injection is usually a “one-time” option and should only be considered if the well is to be plugged and abandoned, it is not suitable for continuous disposal. However, there is a threat of corrosion of the surface pipe or other casing. If the surface pipe is breached by corrosion the injected fluids may enter usable water sources.

8.5.1.5 Preferred Method

Given the above assessment, and considering the surrounding landscape and forest, there limited locations for landspreading, further there are no suitable landfill sites close the location, so in-situ disposal during restoration work is the only viable option. In the case of an unsuccessful campaign and the well is abandoned annular disposal could be considered at that time with the approval of ANPM.

8.5.2 Drilling Fluid (Mud) Alternatives

As discussed above regarding the decision to drill straight holes, the decision on drilling fluids was similarly made prior to the drilling campaign in PSC TL-OT-17-08. Water-based muds will be utilised on the well in PSC TL-OT-17-09 since this well directly follows on from the PSC TL-OT-17-08 program. It should be noted that water based muds are considered the preferable environmental option compared with Non Aqueous Drilling Fluids (NADF).

While NADFs can be required to assist in a number of ways including with higher temperature wells, borehole stability issues e.g. swelling shales, and aiding with increased lubricity in deviated wells, this comes at trade off with the increased toxicity of certain compounds often included in these drilling fluids. The use of NADFs result in the need for additional personal protective equipment for workers and more complex handling procedures that add considerable complexity to operations and also pose as an additional environmental contamination risk during subsequent disposal of cutting.

8.5.3 Incineration

Incineration uses combustion to convert wastes into less bulky materials. Incineration can refer to the practice of open burning of wastes in pits, although the degree of combustion achieved in commercial incinerators will be difficult to achieve in open burning. This is because commercial incinerators can control the residence time, temperature and turbulence within the incineration chamber to optimise combustion. The amount of waste arising throughout the project are discussed in Section 9.3.6.2 and waste management presented in the project Waste Management Plan. The amount of waste after segregation of recyclables which can be incinerated is considered a small amount compared to community waste arisings in general and the opportunity to utilise an industrial incinerator as opposed to open burning or land fill is regarded as the best option. Thus, incineration is preferred option compared with open burning or landfill.

Waste arisings are small since the drilling program is short, 40 days, as such waste will be stored at an area at rig site used for temporary storage of wastes prior to transfer to the project designated waste reception facility near to Haemanu supply base, where wastes will be segregated and managed as discussed in Section 9.3.6.2.

9 MEASURES OF IMPACT ASSESSMENT AND MITIGATION

9.1 METHODOLOGY AND APPROACH

The methods used for the identification and assessment of potential impacts associated with the project meet Timor-Leste legislative requirements, as defined under Environmental Licensing Decree Law 5/2011 and supporting Ministerial Diploma 46, in particular, Annex IV EIA Template. The approach also to meets Timor Resources Operating Management System (OMS) and the agreed drilling program.

The team followed internationally accepted methodology and best practices such as the International Finance Corporation: Environmental Health and Safety (EHS) Guidelines for Onshore Oil and Gas Development (IFC 2007a); EHS General Guidelines (IFC 2007b); and IFC Performance Standard 1 (PS 1) - Assessment and Management of Environmental and Social Risks (IFC 2012).

The assessment process also followed oil and gas industry best practice such as the industry standard on environmental management - "*Environmental Management in Oil and Gas Exploration and Production*". UNEP Technical Report 37, 1997. ISBN 92-807-1639-5. IOGP Report No. 254.

Ministerial Diploma 46, Annex IV, further describes the approach required by the proponent to identify the project impacts, in particular for each project phase: construction, operation and decommissioning. Further, the assessment should address direct and indirect impacts, cumulative impacts, the impacts of climate change, the short, medium and long term impacts, temporary and permanent impacts, positive and negative impacts.

Impact assessment and mitigation measures are addressed under the following headings:

9.1.Methodology and Approach
9.2.Scope of the Assessment
9.3.Impact Identification, Significance and Mitigation
9.4.Summary of Impacts and Mitigation
9.5.Residual impacts

9.1.1 Types of Impacts and Definitions

An impact is any change to a resource or receptor brought about by the presence of a project component or by the execution of a project related activity. The evaluation of baseline data provides crucial information for the process of evaluating and describing how the project could affect the biophysical and socio-economic environment. Table 9-1 describes Impacts according to their nature or type.

Table 9-1. Impact Nature and Type

Nature or Type	Definition
Positive	Impact that is of benefit to the receiving environment
Neutral	Impact that has No Cost or benefit to the receiving environment
Negative	Impact that is a considered to represent an adverse change or introduces a new undesirable factor; A cost to the receiving environment
Direct	Impact that results from a direct interaction between a planned project activity and the receiving environment
Indirect	Impact that results from other activities that are encouraged to happen as a consequence of the project activity

9.1.2 Characterisation of Impacts

Predicting impacts is essentially a subjective value judgement exercise, based on qualitative or semi-quantitative approach, to determine what is likely to happen to the environment as a consequence of the drilling project. In order to address the significance of any impact it is necessary first to describe the character, nature and type of impacts that are to be considered.

The criteria used to describe impact characteristics are detailed in the Table 9-2 below, and are summarised as follows:

- **Extent:** The spatial scale of the impact (i.e. site-specific, local, regional, national and or international).
- **Duration:** the temporal scale of the impact, the time period over which the effect will last (i.e. short-term, medium-term, long-term, permanent).
- **Intensity - environment:** sensitivity, resilience and/or ability to function.
- **Intensity - social/cultural/economic:** number of elements - individuals/households; communities/Sucos/Post Administrative/Municipality; and enterprises, that could be affected by the impact.
- **Likelihood:** the frequency/probability of impact or how often it might occur (i.e. not probable, probable, highly probable, definite).

The terminology used to describe the impact characteristics are provided in Table 9-2, and magnitude is illustrated in Figure 9-1.

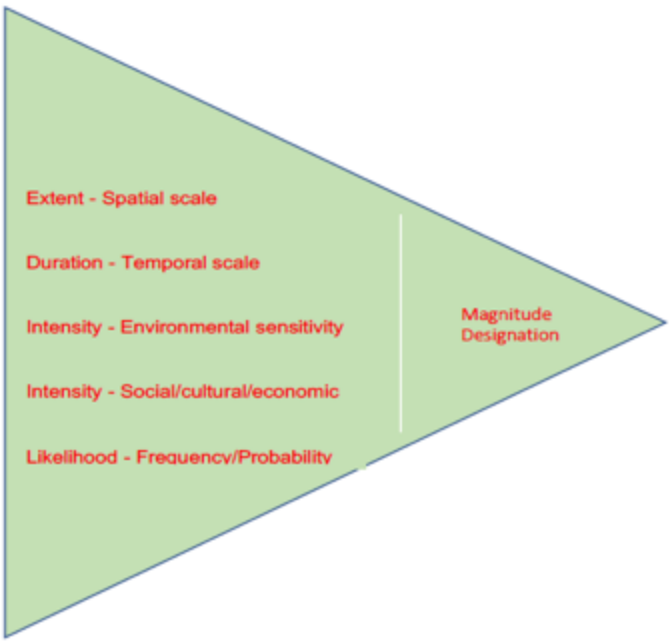


Figure 9-1. Assessing the Level of Magnitude

Table 9-2. Significance - Evaluation Criteria

CHARACTERISATION OF IMPACT	EVALUATION CRITERIA	RANKING
EXTENT	**Site-Specific:** Impact that are limited to the boundaries of the project site	1
	Local: Impacts that extends beyond the site boundary; affects the immediate surrounding environment (i.e. up to 5 km from Project Site Boundary)	2
	Regional: Impact that extends far beyond the site boundary; widespread effect (i.e. 5 km and more from the Project Site Boundary)	3
	National and/or international: Impact that extends far beyond the site boundary; widespread effect	4
DURATION	**Short-term:** Impact that is quickly reversible; 0-5 years	1
	Medium term: Impact that is reversible over time; 5-15 years	2
	Long-term: Impact that lasts 16-30 years	3
	Permanent: Impacts that last over 30 years and resulting in a permanent and lasting change that will remain	4
INTENSITY - ENVIRONMENT	**None:** The impact on the environment is not detectable	1
	Low: Low value. The impact affects the environment in such a way that natural functions and processes are not affected	2
	Medium: Moderate value. Where the affected environment is altered but natural functions and processes continue, albeit in a modified way	3
	High: High value. Where natural functions or processes are altered to the extent that they will temporary or permanently cease. Where the affected environment is permanently altered	4
INTENSITY OR NUMBER OF ELEMENTS - SOCIAL, CULTURAL AND ECONOMIC	**None:** Affecting a small number of Individuals/households, individual enterprises.	1
	Low: Affecting a small number of Individuals/households, communities or Sucos, small enterprises.	2
	Medium: Affecting more Individuals/households, communities, Sucos or Post Administrative, medium enterprises.	3
	High: Affecting a large number of Individuals/households, communities, Sucos, PA or Municipality, large enterprises	4

IMPACT	TIME SCALE OF IMPACT - LIKELIHOOD	RANKING
LIKELIHOOD	**Improbable:** Possibility of the impact materialising is negligible; chance of occurrence <10%	1
	Probable: Possibility that the impact will materialise is likely; chance of occurrence 10-49%	2
	Highly Probable: It is expected that the impact will occur, chance of occurrence50-90%	3
	Definite: Impact will occur regardless of any prevention measures, chance of occurrence >90%	4

9.1.3 Impact Significance

Impacts are described in terms of "*significance*". Significance is a function of the magnitude, severity or consequence of the impact based on the Evaluation Criteria and the likelihood of the impact occurring. Once an assessment is made of the magnitude and likelihood, the impact significance is rated through a matrix process as shown in Table 9-3 and Table 9-4 below.

Table 9-3. Significance Rating Matrix

SIGNIFICANCE					
EVALUATION CRITERIA		**LIKELIHOOD**			
Extent Duration Intensity - Environment Intensity - Social/Cultural/Economic		**Improbable 1**	**Probable 2**	**Highly Probable 3**	**Definite 4**
Site Specific/Short-term/None/None	**1**	**1 Negligible**	**2 Negligible**	**3 Negligible**	**4 Negligible**
Local/Medium Term/Low/Low	**2**	**2 Negligible**	**4 Negligible**	**6 Minor**	**8 Minor**
Regional/Long Term/Medium/Medium	**3**	**3 Negligible**	**6 Minor**	**9 Moderate**	**12 Moderate**
National/Permanent/High/High	**4**	**4 Negligible**	**8 Minor**	**12 Moderate**	**16 Major**

Table 9-4. Significance Ranking

SIGNIFICANCE RANKING	IMPACT LEVEL
13 - 16	Major
9 - 12	Moderate
5 - 8	Minor
1 - 4	Negligible
Positive impact	Beneficial

9.1.4 Mitigation Measures and Residual Impacts

In developing the mitigation measures, the EIA team relied upon on the internationally applied methodology that included lessons learnt from previous studies and the best practices such as the IFC/World Bank general EHS Guidelines and from the insight gained during fieldwork and stakeholder engagement exercise.

For activities with significant impacts, the EIA process is required to identify suitable and practical mitigation measures that can be implemented, and this is achieved through the implementation of the EMP. Finally, the impacts were re-evaluated assuming the appropriate mitigation measures are effectively applied, and this resulted in a significance rating for the residual impact under the EMP.

9.2 Scope Of The Preliminary Assessment

The scope of the project is described in the approved Project Document (13th August 2020 - ANPM/HSE/S/20/096) and EIA Terms of Reference (26th January 2021 - ANPN/HSE/S/21/021 2021).

IFC PS 1 advises that the scope of an impact identification process should be consistent with good international industry practice, which it describes as "*the exercise of professional skill, diligence, prudence, and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally or regionally*".

The scope of this study covers pre-drilling/construction, drilling and decommissioning, including all activities under each phase. The area selected for study was chosen, to be sufficiently large enough to consider a range of possible locations for the initial exploration well, but also to allow for possible follow up appraisal drilling within the area if required in the event of success. The Area of Interest (AOI) has been taken as 10 km.

This spatial concept has also been considered when assessing potential impacts and their extent and duration as presented in Section 9.3 and summarised in Section 9.4 (i) key Aspects; (ii) potential impact rating; (iii) a range of mitigation measures, and (iv) likely residual impact. In considering the spatial scope, each of the potential impacts were considered and the AOI, as described above, adequately addresses each, noting that for all, save perhaps a worst-case oil spill, the potential impact zone is considered to be significantly smaller than the AOI. The AOI for a worst-case spill will be addressed in the Site Specific Operational Oil Spill Plan.

It focuses primarily on the 2.5 hectares well site and considers sensitive locators within a 10 km range of the Rusa-1 well site, the primary sensitive locators are summarised in Table 9-5

Table 9-5. Sensitive Locations in and around the drilling area

Well site	Location	Relevant Study area	Distance (km)	Centroid Coordinates	
				Latitude	Longitude
Rusa-1	Aldeia Sessurai	School area	1.06	09º 06'31.1" S	125º 41'44.8" E
	Aldeia Fatukabelak	Resident Settlement	0.93	09º 07' 05" S	125º 41' 33.8 "E
	Aldeia Raimerlau	Resident Settlement	0.47	09º 06 '52.5" S	125º 41" 00" E

The potential impacts identified in the approved TOR include the following components, with the Environmental Components discussed in Section 9.3 and the Social and Economic impacts addressed in Section 10 and Section 11 respectively.

Environmental Components (See Section 9.3)

1. Decreasing Air quality – construction and operation, principally dust and generator and vehicle emissions
2. Noise - increasing noisy condition during construction and operation phase; drilling activities, increased traffic along the main road – predicted noise levels compared to existing background levels
3. Water quality potential degradation but ground water dependent – changes pH, ammonia, sedimentation and other parameters also ground water dependent
4. Land use change – conversion of public and private land uses into drilling site, facilities, areas, current land use and cover
5. Habitat destruction/degradation and biodiversity loss
6. Solid waste - solid waste management, garbage from rig and camp
7. Wastewater and stormwater – sewage treatment; wash water; rain water; hazardous material spills.

Economic, Social and Cultural Components (See Section 10 and Section 11)

1. Land acquisition and physical displacement – number of households and people affected, land types and areas acquired, etc.
2. Economic displacement and livelihoods – local businesses and employment
3. Loss of cultural heritage sites – types and significance of sites
4. Safety - worker and community safety pre-operation during construction, operation and decommissioning
5. Traffic – during construction and operation, primarily between Suai and the drilling site
6. Employment- increased employment opportunities, and increased support services opportunities, e.g. shops and transport services.

9.3 PRELIMINARY IMPACT IDENTIFICATION AND ASSESSMENT

The following sections discuss the findings of a preliminary assessment of impacts and relate to Section 4 - Project Description and Section 6 - Environmental Description. Each of the sub-sections describe the process, the potential impact, their significance and describes mitigation measures that are considered in project design and execution.

Section 9.3.1 Describes the preliminary assessment of Positive Impacts arising from the project, whilst the succeeding sub-sections identify potential negative impacts. The significance of the negative impacts is assessed followed by a description of the proposed mitigation measures.

Impacts are described for Pre-drilling/Construction, Drilling and Decommissioning.

9.3.1 Positive Impacts

9.3.1.1 Employment Opportunities

Construction (Timorese labour component 88)

There will be several employment opportunities during the construction phase for: community consultation, community liaison officers, civil construction crews, civil engineers, concreters, heavy vehicle drivers, light vehicle drivers, supervisors, engineers, mechanics, electrician surveyors, labourers, accommodation manager, security, administration, accounting service, cooks, cleaners, security, geologists, administration, accounting, operations management, work team supervisors.

Operations (Timorese labour component 114)

Additional employment during the operations phase includes rig related labour, inclusive of drilling crew, derrickmen, roustabouts, company men, geologists, security, labourers, and crew. In addition, the following positions remain important: concreters, heavy vehicle drivers, light vehicle drivers, supervisors, engineers, mechanics, electricians, surveyors, labourers, accommodation manager, security, administration, accounting service, cooks, cleaners, administration, accounting, operations management, work team supervisors.

Decommissioning (Timorese labour component 88)

Company men, geologists, security, labourers, and crew. In addition, the following positions remain important: heavy vehicle drivers, light vehicle drivers, supervisors, engineers, mechanics, electricians, surveyors, labourers, accommodation manager, administration, accounting service, cooks, cleaners, administration, accounting, operations management, work team supervisors.

9.3.1.2 Procuring Goods and Services

Procurement from Timorese owned and operated businesses in the contract area goods and services include but are not limited to:

1. Fresh Food and water
2. Accommodation Housing/Office Supply
3. Diesel Supply
4. Import Services for customs clearance
5. Rental of Heavy Equipment, trucks, cranes
6. Environmental Consultancy Engagement
7. Aggregate and rock base

In preparation for the local suppliers to be able to offer their goods and services Timor Resources has undertaken promotional workshops and engagements to educate the local suppliers as to what they can supply and in what quantities they can participate. Raising the standard of the local suppliers, to be able to participate in the tender process and to be a supplier has been an activity undertaken over 18 months already in working with the communities and the local district administrator, in preparation.

9.3.1.3 Customs Duties and Taxes

The use and consumption of various specialist drilling materials, such as machinery, mud components, drill bits, etc. will attract taxes and customs duties, which will be payable to the government hence increasing government revenue while the cost of these materials will be payable directly to the producers.

Imported equipment will net greater than US$350,000 in import duties as heavy equipment comes into the country.

Withholding will be payable on employment and contracts, providing revenue to the state exceeding US$520,000.

9.3.1.4 Community Programs

Timor Resources has implemented a number of community programs, including horticulture, gifted seeds, irrigation and financial support. The supply of irrigation and water infrastructure has been the focus of Company support during seismic and is continuing during the drilling campaign.

Support for local sporting competitions, teams and local events is another community contribution. The sponsoring of the Manufahi Cup, the Tour de Dili, and the local community football and soccer federations.

Infrastructure within the area is set to improve especially the roads leading to the site after improvement eases access of transportation. The roads to the site will also serve other residents who are set to benefit from this infrastructure development brought by the project.

9.3.2 Land

“Land” covers both direct land use and traffic impact on the community and also soil related aspects resulting from land disturbance throughout all project phases: pre-project/ construction, operations and decommissioning.

9.3.2.1 Land Use

The well site is approximately 2.5 ha in area which includes an allocation of land for the well pad (approximately 1ha), where on private land, a short-term rental payment will be negotiated with the landowner. Access road requirements vary depending on the well location, but leasing will be conducted in the same manner as the Well site.

Section 4.4.3 provides detailed maps of the drilling location delineating existing and the proposed new access road, the major drainage systems (see Figure 4-7 access roads, and Figure 4-8 catchment to the well site and out flow), urbanised areas and other infrastructure boundaries.

The access road will be constructed on 500m of existing public road and a new section to the well site of approximately 425m in length. Both sections will be 6m wide with 10m to 20m of clearance for wide loads. Locally sourced rock will be used as base course up to 30 cm in

thickness for the roads. Existing public infrastructure such as highways and local roads, bridges and underpasses will be assessed. If required, they will be upgraded or modified with approval of the relevant authorities to allow for the safe mobilisation of the equipment to the project locations.

Land use impacts may occur throughout the project phases, if there are conflicts with existing land use such as habitation, agriculture, forest, grazing lands, etc., and where the land is occupied by the drilling rig. Typically, the surface location can be selected to avoid use of inhabited or productive land and should always consider occupying land that is already disturbed.

9.3.2.1.1 Land Use Impact Significance

Table 9-6. Significance Impact on Land Use

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	Impacts that extends beyond the site boundary; affects the immediate surrounding environment (i.e. up to 5 km from Project Site Boundary)	8
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	4
Intensity - Environmental	Low	2	The use of the land is temporary and will be returned to the landowner. Natural functions and processes are not affected.	8
Intensity - Social/Cultural/ Economic	Low	2	Affecting a small number of Individuals/households, communities or Sucos, small enterprises.	8
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Minor**	**7**

9.3.2.1.2 Mitigation Measures - Land Use

- Contact local stakeholders early in the process to identify sensitive land areas, land uses, issues, and local plans and any local regulations.
- Site the project on previously disturbed land whenever possible.
- Depending on the individual site, consider steps to minimise the amount of vehicular traffic and human activity.
- Provide adequate public notice of planned activities.
- Establish a rehabilitation plan that addresses both interim and final rehabilitation requirements and agree after-use if applicable. Ensure that interim rehabilitation of disturbed areas is conducted as soon as possible.
- Compensate farmers for crop damage and restore compacted soils.

9.3.2.1.3 Residual Impact - Land Use

The project is limited spatially to the drilling location and immediate surrounds and is short term and transient in nature, any potential impacts are insignificant. The implementation of the land use mitigation measures will contribute to reducing the significance of the residual impact associated but the residual impact on land use remains **Minor**.

Table 9-7. Pre and Post Mitigation Significance: Impact on Land Use

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
All	Minor	Minor

9.3.2.2 Traffic

Vehicular movements will occur along local access routes and access roads throughout the project - construction/operations/decommissioning. Vehicle congestion may occur on local roads during construction with trucks carrying the rig, delivering the construction plant and rig facilities and other small vehicles carrying workers to the site. There will be daily vehicle movements to and from the site throughout the operating phase for re-supply purposes, and similar issues may arise during decommissioning. These impacts will mainly be a source of annoyance to local residents but will increase the potential of safety related incidents for other road users and local residents living and working within a close proximity to the access roads and the site.

Strict traffic management procedures will be implemented which will also limit all traffic movement through villages and in particular at school opening and closing times.

9.3.2.2.1 Traffic Impact Significance

Table 9-8. Traffic- Significance Traffic Impacts

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Regional	3	The potential impact may affect 5 km or more around the site.	12
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	4
Intensity - Environmental	None	1	The impact on the environment is not detectable, therefore discount as a criterion	-
Intensity - Social/Cultural/ Economic	Medium	3	Affecting more Individuals/ households, communities, Sucos or Post Administrative, medium enterprises.	12
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Moderate**	**9**

9.3.2.2.2 Mitigation Measures - Traffic

Control of traffic build-up throughout the project phases will be achieved by observing the following measures:

- Plan to use existing roads to the maximum extent possible.
- Prepare an access road siting study and management plan to guide road design and maintenance standards, coordinate closely with Municipality and national government authorities responsible for maintaining roadways and bridges. Compare the number, size, and weight of loads to service projects to the existing road infrastructure to determine if roads and bridges are adequate to support intended loads.
- Implement strict traffic management procedures in association with the Municipality.
- Route project traffic to minimise impacts on local communities.
- Issue notices/advisories of pending traffic inconveniences and conduct briefing meetings with local authorities, schools and residents before the commencement of works.
- Flagmen should be employed to control traffic and assist all vehicles as they enter and exit the project site.
- Maintain on site a record of incidents and accidents.
- Ensuring that all drivers for the project understand and comply with speed limits.
- Ensure all vehicles and machinery used for the project are in good working condition both legally and are fit for purpose.
- Control dust along un-surfaced roads, especially near residences, schools and fields.
- Limit all traffic movement through villages in particular school opening and closing times.

9.3.2.2.3 Residual Impact - Traffic

The project is limited spatially to the drilling location and immediate surrounds and is short term and transient in nature, the implementation of the traffic mitigation measures will contribute to reducing the significance of the residual impact associated with traffic impact to **Minor**.

Table 9-9. Pre and Post Mitigation Significance: Traffic Impact

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
All	Moderate	Minor

9.3.2.3 Soil

The exploration drilling campaign requires the building of a well site and access roads from the nearest public roads. Construction activities will involve vegetation clearing, mixing of soil horizons, soil compaction, increase susceptibility of soil to wind and water erosion, loss of topsoil productivity and potential contamination of soils with petroleum products (See Section 9.3.4.3 leaks and spills). The arable topsoil and vegetation are stockpiled on the side of the well site within the fence line or in the case of access corridors, to the side of the road. The topsoil will be used to rehabilitate the site once drilling is completed in areas which are no longer required.

The well site area of 2.5 ha in total which includes an allocation of land for the well pad (approximately 1ha) will be levelled after topsoil is removed and river rocks will be used as base course up to 50 cm in thickness. If the geotechnical survey dictates, additional foundation will be used under high load bearing areas. The well site incorporates two mud pits each with a

volume of approximately 334 m^3 (2,100 bbls), a freeboard of 0.5m and lined with a High Density Polyethylene (HDPE) membrane liner.

Impact to soils is proportionate to the amount of disturbance, thus, given the minimal size of land used for the well site, approximately 100 m x 100 m the potential impacts may be considered minor.

Activities during the decommissioning phase include removal of the well pad and access roads. Similar to the impacts recorded in the construction phase, movement of machinery and loading and offloading of transport vehicles present a threat to the soil structures and characteristics and changes in the runoff patterns could cause soil erosion.

9.3.2.3.1 Soil Impact Significance

Table 9-10: Significance Impact on Soil

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	Impacts are predominantly limited to the boundaries of the project site but may extend beyond the site where access roads are constructed	8
Duration	Short-term	1	Although removal of topsoil and soil compaction will occur largely during the construction phase, the effect will continue through operations until the site are decommissioned and rehabilitated.	4
Intensity - Environmental	Medium	3	Topsoil removal and soil compaction will be limited to specific areas of the well site and access road if applicable. The affected environment is altered but natural functions and processes continue, albeit in a modified way	12
Intensity - Social/Cultural/ Economic	None	1	Affecting a small number of Individuals/households, individual enterprises	4
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Minor**	**7**

9.3.2.3.2 Mitigation Measures - Soil

Construction

- Restricting removal of vegetation and soil cover to those areas necessary for the project.
- Remove all topsoil and store off site.
- Manage storm and flood flash water effectively to avoid movement of loss soils.
- The disturbed areas should be rehabilitated with indigenous vegetation as soon as possible to prevent soil erosion if it was necessary.
- Work areas should be clearly defined and demarcated, where necessary to avoid unnecessary disturbance on areas outside the project footprint.
- Preventing pollution of ground from servicing of vehicles and wastes by having specific sites for collection, sorting and transport of wastes.
- Construction vehicles should remain on designated roads and should avoid off-site driving.
- Compacting area with loose soils.

Decommissioning

- Soil originally removed in the construction phase and stored will be returned upon restoration of the drill site and access road if necessary.
- Drains will be installed, and drainage patterns will be re-established to prevent erosion.
- Well site and roads are either left to an agreed after-use or rehabilitated following drilling. If the well is successful, the area will be reduced to the minimum size necessary in discussion with the authorities and the landowner.
- During restoration and rehabilitation of the well site and roads, the site will be ripped before returning of the stockpiled topsoil.
- Soil profile and contours will be reinstated upon completions of decommissioning phase.

9.3.2.3.3 Residual Impact - Soil

The project is limited spatially to the drilling location and immediate surrounds and is short term and transient in nature, the implementation of the soil mitigation measures will contribute to reducing the significance of the residual impact associated with the impact on soil to **Minor**.

Table 9-11. Pre and Post Mitigation Significance: Impact on Soil

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
All	Minor	Minor

9.3.3 Air Quality

Dust

Construction and decommissioning activities may generate dust caused by a combination of on-site excavation and movement of earth materials, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind. Vehicle movements along gravel access roads, where present, may raise dust during the operations phase. These activities are likely to generate air quality impacts related to dust and can be measured and monitored as Particulate Matter (PM), see Section 6.1.4 for discussions on background levels of $PM_{2.5}$ and PM_{10}.

To reduce impacts from dust during the construction, operations and decommissioning phases, the main mitigation measures will be:

- Watering - dust suppression
- Speed reduction
- Vehicle movements restricted to site and access roads

Gaseous Emissions

Emissions to the atmosphere from the drilling program will mainly arise from combustion products resulting from diesel engine exhaust, both the rig generators and service vehicles, and from hydrocarbon flaring if the well is tested see Table 9-12. The major sources and typical emission gases arising are combustion products from burning of diesel fuel, mainly CO_2 and H_2O resulting from the oxidation of hydrocarbons. CO, CH_4, NO, NO_2 and N_2O gases will be emitted in the exhaust as well as unburnt hydrocarbons and particulates. Some sulphur may be released depending on the sulphur content of the diesel fuel.

Additional pollutants may include hydrogen sulphide (H_2S) although there is no evidence to suggest H_2S is present in the region; volatile organic compounds (VOC); glycols; and polycyclic aromatic hydrocarbons (PAHs), although 95%-99% PAH is destroyed in combustion in the engine/generator.

Table 9-12. Drilling Emission Sources

Emission Source	Purpose	Treatment	Point of Emission	Emission Gas
Diesel fuel	Engines for power production: rig and vehicles	Combustion	Engine exhaust	CO_2,NO_X,VOC,CH_4,CO,N_2O
Well testing	Testing of wells	Combustion	Burner	CO_2,NO_X,VOC,CH_4,CO,N_2O
Other direct hydrocarbon emission	Drilling fluid Well clean-up Fugitives and Leaks Produced water Storage tanks	None None None None None	Evaporative Vent stack/tanks BOP Vent stack Vent stack	VOC,CH_4 VOC,CH_4 VOC,CH_4 VOC,CH_4 VOC,CH_4

Major Emission Gases

Carbon Dioxide (CO_2): is the main product of combustion, together with water. It is a non-poisonous gas. However, the major environmental impact receiving attention is its contribution to the global atmospheric greenhouse effect. Whilst it is the weakest in terms of specific greenhouse effect, the large emission quantities make it the predominant contributor.

Carbon Monoxide (CO): is a poisonous gas produced from incomplete combustion, low in terms of quantity and greenhouse effect.

Nitrogen Oxides (NOx): is the common term for nitric oxide (NO) and nitrogen dioxide (NO_2). NO is rapidly oxidised in the atmosphere to the more toxic nitrogen dioxide. Both gases contribute to acidic deposition whether through precipitation or dry deposition. NO_x, in combination with volatile hydrocarbon components (VOC), forms photochemical oxidants as secondary pollutants, with properties and effects quite different from those of their original components, and impacts over large distances. The most important of these secondary photochemical oxidants is Ozone (O_3), which, in the lower atmosphere, interacts with other air

pollutants and contributes as a greenhouse gas. Ozone in the upper layers or stratosphere is subject to a different phenomenon - ozone depletion.

Nitrous Oxide (N_2O): is produced in smaller quantities during combustion processes and is a strong greenhouse gas.

Methane (CH_4): is a non-poisonous gas and, although emitted only in small quantities from oil and gas operations, its high potency in terms of greenhouse effect makes it a key consideration.

Volatile Organic Compounds (VOC): is a common term for all volatile hydrocarbon components except methane, it does not have a strong greenhouse effect, but in combination with NOx produces photochemical oxidants, particularly ozone, as a secondary pollutant. Some components such as benzene and polycyclic aromatic hydrocarbons pose significant health risks.

Halon and CFC: are synthetic, non-poisonous gases, which have received much attention in recent years for their effects in the degradation of ozone in the upper atmosphere. Both have a strong greenhouse effect.

Hydrogen Sulphide (H_2S): is a toxic flammable gas. It is denser than air and tends to accumulate in low lying areas. In a rig environment, if the gas is vented downwind it disperses and is soluble in atmospheric moisture. The environmental impact is negligible, however, because of the acute toxicity, the main concerns are with human safety. H_2S is not expected in this project.

During well testing the intent is to separate the hydrocarbon test fluids to avoid a smoky flare with fall out that may impact the nearest community. Alternative disposal options may be considered, but it is necessary to fully consider the safety of handling volatile hydrocarbons and if deemed unsafe the fluids may be burnt or incinerated.

If flaring is the only option available for the disposal of test fluids, an efficient test flare burner head equipped with an appropriate combustion enhancement system will be selected to minimise incomplete combustion, black smoke, and hydrocarbon fallout. In addition, the minimum volume of hydrocarbons required for the test will be flowed and well test durations will be reduced to the extent practical.

The Project Description Section 4.4.3 presented a map of the well location and any nearby receptors, maps covering the Rusa-1 drilling location, the Betano base camp and Haemanu supply base are provided above in Figure 4-8 and Figure 9-3 to Figure 9-5 . Figure 4-9 covers an area of approximately 3 km radius from the well location.

From these maps the following can be concluded regarding receptors:

Rusa-1: The wellsite lies on a flat area, between two small natural watercourses on a generally south-easterly dipping slope. The catchment area draining to the wellsite is of limited extent (2,551 m^2) and will be diverted to the adjacent watercourses. Two knickpoints in the watercourses have been identified as suitable locations for spill containment of approximately 25,000 bbls if required.

The area surrounding the site has a low habitation density, noise and air quality impacts will be low and will be monitored.

The location is susceptible to access issues if operations were to be conducted in the wet season. The gradients on the Hatu-Udo road are high in places and could preclude movement of heavy equipment if on unsealed sections and wet.

Betano Base Camp: The camp at Betano has been operational from 2018 to the present day, during the seismic acquisition in 2019 the accommodation at the camp was more than 100 people. There has been no significant impact on the surrounding community since the camp was installed, this is expected to continue through the drilling operation. Emissions from the camp will be low, the main contributions being from a small generator to provide camp power if the EDTL supply is interrupted. There will be no dust arising from the camp as all are on compacted ground.

Haemanu Warehouse and Yard: emissions from the warehouse and yard operations will be low, as with the Betano Camp the main contributions being from a small generator to provide power if the EDTL supply is interrupted. There will be no dust arising from the warehouse or yard area as all are on hardstanding.

Without mitigation measures, air quality impacts from air pollutants emitted by generator combustion throughout the project are expected to be local in extent, short-term in duration, reversible and of small magnitude.

The emissions from vehicles will be transient, intermittent and spatially variable, therefore it is expected only a small incremental increase in combustion-based air pollutants will be generated by the project.

Assessment Criteria

In the absence of air quality legislation or regulations, recognised international guidance from IFC and WHO will be used in this study (see Table 9-13). Regarding air quality IFC refers to the WHO guideline values for particulate matter, ozone, nitrogen dioxide and sulphur dioxide. In this project the principle potential impacts relate to dust arising from construction activities and emissions from diesel engines both for power generation and in plant and vehicles. As such this study focuses on particulates ($PM_{2.5}$ and PM_{10}) and NO_2 and SO_2, the former using available secondary data and limited primary data collection as comparisons. In the case of engine emissions, the levels will be calculated using recognised emission estimate methodology applicable to diesel engines.

Table 9-13. WHO Ambient Air Quality Guidelines 2005

	AVERAGING PERIOD	GUIDELINE VALUE µg/m^3
Sulphur dioxide (SO_2)	24-hour mean 10-minute mean	20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	Annual mean 1-hour mean	40 (guideline) 200 (guideline
Particulate Matter PM_{10}	Annual mean 24-hour mean	20 (guideline) 50 (guideline)
Particulate Matter $PM_{2.5}$	Annual mean 24-hour	10 (guideline) 25 (guideline)
Ozone	8-hour mean	100 (guideline)

9.3.3.1 Air Quality Impacts - Construction

Construction activities will also produce various air pollutants, which can have both negative effects on both human and environmental health. The potential for air quality impacts comes primarily from dust and engine emissions. Dust will be generated by earth works and excavation and the extent of the raising of dust will depend on several factors such as:

- The moisture and silt content of the materials
- Distances travelled on unpaved surfaces
- The mitigation measures employed
- The type of construction activities occurring (e.g. excavation)
- Volume of material being moved
- The area of exposed materials

Engine emissions arise from construction equipment, transport trucks, personal vehicles, power saws, and generators.

9.3.3.1.1 Air Quality Impact Significance - Construction

Table 9-14. Construction - Significance Impact on Air Quality

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	The potential impact may affect 5 km or more around the site.	8
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	4
Intensity - Environmental	Medium	3	The decrease in Air Quality will be temporary but may create dust nuisance and impact on the fauna and flora around the project site.	12
Intensity - Social/Cultural/ Economic	Medium	3	Affecting more Individuals/ households, communities, Sucos or Post Administrative, medium enterprises.	12
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Moderate**	**9**

9.3.3.1.2 Mitigation Measures - Construction Air Quality

- Sprinkling water on soil before excavation and periodically when operations are under way to prevent raising of dust.
- Use of low sulphur fossil fuel.
- Controlling the speed and operation of construction vehicles; drivers should adhere to the speed limit of 20 km/hr on access roads and 40 km/hr on blacktop roads.
- Regular maintenance and services of machines and engines.
- In order to control exhaust, educate and raise awareness of construction workers on emission reduction and on emissions that are likely to occur during the construction of the well pad and access roads leading to the site, the following measures shall be implemented during construction:
    - Vehicle idling time shall be minimised
    - Equipment shall be properly tuned and maintained.
- To minimise air pollution due to dust emission or transport of waste materials during construction, the waste materials must be transported in covered vehicles especially if the route is through frequently used roads.
- Workers in dusty areas on the site need to be issued with PPE such as, dust masks and safety goggles during dry and windy conditions.
- Sensitise truck drivers to avoid unnecessary racing of machinery engines at loading, offloading sites, and parking areas and encourage them to keep the vehicle engines off at these points.

9.3.3.1.3 Residual Impact - Construction Air Quality

The implementation of the construction mitigation measures will contribute to reducing the significance of the residual impact associated with the Impact on Air Quality to **Minor**.

Table 9-15. Pre and Post Mitigation Significance: Construction Impact on Air Quality

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
Construction	Moderate	Minor

9.3.3.2 Air Quality Impacts - Operations

There will be limited source of dust during operations arising from vehicle traffic on gravel access roads. The main air quality emission source during operations is the burning of diesel in the rig generators and service vehicles. Total diesel fuel consumption for the well is estimated to be 5000 L per day for rig generators and transport. The well program is expected to take 40 days and based on this, the emissions can be calculated and are presented in the table below with some 480 tonnes CO_2 is produced per well and 500 tonnes of GHG.

Table 9-16. Emission Estimates per Well Resulting from Diesel Generators

(Derived from OGP (ex E&P Forum) Tier 3 estimation method.
CO_2 equivalents (CO_2E) are calculated using Global Warming Potentials (GWPs) from the Intergovernmental Panel on Climate Change's Fourth Assessment Report.)

Emission Gas	Tonnes	CO_2E (3) Tonnes
CO_2	480 (1)	480
CO	3.45	-
NO_x	8.10	-
N_2O	0.03	8.94
SO_x	0.60 (2)	-
CH_4	0.03	0.75
VOC	0.55	-
GHG	496.23	489.69

(1) *assumes carbon content of 85% by weight for diesel fuel*
(2) *sulphur content assumed as 0.2% by weight for diesel fuel*
(3) ** EPA greenhouse-gas-equivalencies calculator (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator).*

The total release of CO_2E during the drilling operation is estimated to be 490 tonnes of CO_2E per well, as shown in . Significant greenhouse gas (GHG) emissions occur from all oil and gas operations worldwide (>100,000 tons CO_2 equivalent per year) IFC (2007).

The levels of gaseous emissions in the project are very low, and whilst there is an overall contribution in terms of emission gases, the levels are insignificant in comparison with other operations in Timor and globally. For example, in 2018, CO_2 emissions per capita for Timor-Leste was 0.2 metric tons, population approximately 1¼ m which is some 275,000 tonnes. Source (World Data Atlas, 2018).

Timor-Leste is a minor emitter of greenhouse gases, and therefore mitigation is not currently an important issue in the country, but adaptation will be (World Bank 2009). Carbon dioxide emissions (0.2 tonnes) are low compared with Indonesia (1.4 tonnes) but at the same level as Lao PDR. The GHG emissions arising from the proposed activities are insignificant (approximately 0.2%), and therefore will not significantly impact the environment.

The option to use a locally available incinerator is discussed in Section 8.5.3

If hydrocarbons are discovered a well test program may be instigated, either immediately following the completion of the well, or at a later date. A test separator will be utilised to process any produced hydrocarbons from well testing operations. Gas will be burned in the flare pit using a specialised burner and liquids stored in tanks. A detailed Well Testing program, as required by ANPM, will be issued separately.

9.3.3.2.1 Air Quality Impact Significance - Operations

Table 9-17. Operations - Significance Impact on Air Quality

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	Impacts that extends beyond the site boundary; affects the immediate surrounding environment (i.e. up to 5 km from Project Site Boundary)	8
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	4
Intensity - Environmental	Low	2	The impact affects the environment in such a way that natural functions and processes are not affected	8
Intensity - Social/Cultural/ Economic	Low	2	Affecting more Individuals/ households, communities, Sucos or Post Administrative, medium enterprises.	8
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Minor**	**7**

9.3.3.2.2 Mitigation Measures - Operations Air Quality

- Sprinkling water on access roads to reduce dust.
- Use of low sulphur fossil fuel.
- Speed limit on access road 20 km/hr, 40 km/hr blacktop.
- Regular maintenance and services of machines and engines.
- In order to control exhaust, educate and raise awareness of drivers on emission reduction and on emissions that are likely to occur during the operations, the following measures shall be implemented during construction:
  - Vehicle idling time shall be minimised
  - Equipment shall be properly tuned and maintained
- Sensitise truck drivers to avoid unnecessary racing of machinery engines at loading, offloading sites, and parking areas and encourage them to keep the vehicle engines off at these points.

9.3.3.2.3 Residual Impact - Operations Air Quality

The implementation of the operations mitigation measures will contribute to reducing the significance of the residual impact associated but the impact on Air Quality remains **Moderate**.

Table 9-18. Pre and Post Mitigation Significance: Operations Impact on Air Quality

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
Operations	Minor	Minor

9.3.3.3 Air Quality Impacts - Decommissioning

Emissions generated by activities during the decommissioning phase include vehicular engine combustion emissions; diesel emissions from equipment and generators; and dust from source such as land clearing, structure demolition, cement removal, backfilling, dumping, and tuck movements. Similarly, reclamation of disturbed areas through grading, seeding, and planting may also emit limited dust levels.

9.3.3.3.1 Air Quality Impact Significance - Decommissioning

Table 9-19. Decommissioning - Significance Impact on Air Quality

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	The potential impact may affect 5 km or more around the site.	8
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	4
Intensity - Environmental	Medium	3	The decrease in Air Quality will be temporary but may create dust nuisance and impact on the fauna and flora around the project site.	12
Intensity - Social/Cultural/ Economic	Medium	3	Affecting more Individuals/ households, communities, Sucos or Post Administrative, medium enterprises.	12
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Moderate**	**9**

9.3.3.3.2 Mitigation Measures - Decommissioning Air Quality

High levels of dust resulting from decommissioning works will be minimised by implementing the following measures:

- Covering of all haulage vehicles carrying debris for dumping at approved sites.
- Stockpiles of fine materials should be wetted or covered with tarpaulin during windy conditions.
- Workers in dusty areas on the site should be issued with dust masks and safety goggles.

- Using well maintained equipment and machines with efficient engines meaning low emissions.
- Using dust screens.

9.3.3.3.3 Residual Impact - Decommissioning Impact on Air Quality

The implementation of the decommissioning mitigation measures will contribute to reducing the significance of the residual impact associated with the Impact on Air Quality to **Minor**.

Table 9-20. Pre and Post Mitigation Significance: Decommissioning Impact on Air Quality

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
Decommissioning	Moderate	Minor

9.3.4 Water

9.3.4.1 Surface Water

The potential for impacts to surface water primarily results from storm water runoff or spills. During construction, storm water runoff must be managed to prevent erosion of roads and slopes of the well pad. Such soil erosion, if allowed to reach water courses, could adversely affect surface water quality and may affect aquatic wildlife, however, given the short project timescale, small spatial scale, significant impacts are unlikely. Potential impacts from oil leaks can result from construction heavy equipment. If such spills are not contained on the well pad, they may reach surface water bodies and affect both water quality and aquatic life.

A local topographic survey has been carried out in the area of the proposed well site and combined with a semi-regional Digital Terrain Model to delineate natural drainage patterns by watershed analysis. This analysis allows for planning of diversion of surface water within and around the well site. A 30 m Satellite DTM was used to compute a watershed analysis for the site. The analysis provided the catchment area upstream of the well site and the direction of flow(s) from the site. The Project Description Section 4.4.3 presented maps of the of the well location, any nearby receptors and also illustrated the drainage patterns. The wellsite lies on a flat area, between two small natural watercourses on a generally south-easterly dipping slope. The catchment area draining to the wellsite is of limited extent (2,551 m^2) and will be diverted to the adjacent watercourses. Two knickpoints in the watercourses have been identified as suitable locations for spill containment of approximately 25,000 bbls if required.

The drilling location will have berms to distribute surface water run-off around the site and minimise disruption of natural flow patterns. Surface water that falls on the site will be directed to a watercourse on the downstream side of the well site. A perimeter drainage ditch is constructed around the location. The well also site incorporates two mud pits each with a volume of approximately 334 m^3 (2,100 bbls), a freeboard of 0.5m and lined with an impermeable High Density Polyethylene (HDPE) membrane liner.

During the decommissioning phase, water will be used to control dust from road traffic, dismantling of the well pad and road.

9.3.4.1.1 Surface Water Impact Significance

Table 9-21. Significance Impact on Surface Water

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	The potential impact may affect 5 km or more around the site.	4
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	2
Intensity - Environmental	Medium	3	Potential spills may affect a larger area beyond the site, once they come into contact with runoff or storm water. Where the affected environment is altered but natural functions and processes continue, albeit in a modified way	6
Intensity - Social/Cultural/ Economic	Low	2	Affecting a small number of Individuals/households, communities or Sucos, small enterprises.	4
Likelihood	Probable	2	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Moderate**	**4**

9.3.4.1.2 Mitigation Measures - Surface Water

- Minimise the planned amount of land to be disturbed as much as possible by use of existing roads.
- Identify and avoid unstable slopes and local factors that can cause slope instability (groundwater conditions, precipitation, seismic activity, slope angles, and geologic structure).
- Construct drainage ditches only where necessary. Use appropriate structures at culvert outlets to prevent erosion.
- Refuel in a designated fuelling area that includes a temporary berm to limit the spread of any spill.
- Closely monitor construction near aquifer recharge areas to reduce potential contamination of the aquifer;
- Any discharge of grey water should be treated first to avoid contaminating water sources.
- Upon completion of the decommissioning phase, disturbed areas will be contoured and vegetated to minimise the potential for soil erosion and water quality related impacts.
- Temporary sediment and erosion control measures such as sediment fences installed where necessary especially in areas in close proximity to drains or surface water features to avoid runoff to water source.

- Any area artificially elevated via pad or access track construction will be lowered to original ground level by removal of paving material unless otherwise instructed by the landowners.
- Original drainage patterns will be restored.

9.3.4.1.3 Residual Impact - Surface Water

The project is limited spatially to the drilling location and immediate surrounds and is short term and transient in nature, any potential impacts are insignificant. The implementation of the mitigation measures will contribute to reducing the significance of the residual impact associated with the Impact on Surface Water to **Negligible**.

Table 9-22. Pre and Post Mitigation Significance: Impact on Surface Water

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
All	Minor	Negligible

9.3.4.2 Groundwater

A potential negative impact on groundwater quality may arise from polymers and other additives used when drilling. Remnants and waste from these operations could pollute shallow aquifers, however the shallow aquifer is cased early in the drilling program to prevent contamination of the aquifer.

9.3.4.2.1 Groundwater Impact Significance

Table 9-23. Significance Impact on Groundwater

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Regional	3	The potential impact may affect 5 km or more around the site.	6
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	2
Intensity - Environmental	Medium	3	Potential spills may affect a larger area beyond the site, once they come into contact with groundwater. Where the affected environment is altered but natural functions and processes continue, albeit in a modified way	6
Intensity - Social/Cultural/ Economic	Medium	3	Affecting more Individuals/households, communities, Sucos or Post Administrative, medium enterprises	6
Likelihood	Probable	2	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Moderate**	**5**

9.3.4.2.2 Mitigation Measures - Groundwater

- Conductor casing will be set to case the hole through the shallow ground water aquifers before drilling continues. Based on water well data for aquifer depths in PSC TL-OT-17-08, the deepest regional aquifer was-found at 82 m.
- Mud chemicals are non-toxic with the exception of biocide, but this is used in low quantities.

9.3.4.2.3 Residual Impact - Groundwater

The project is limited spatially to the drilling location and immediate surrounds and is short term and transient in nature, the implementation of the mitigation measures will contribute to reducing the significance of the residual impact associated with the Impact on Groundwater to **Negligible**.

Table 9-24. Pre and Post Mitigation Significance: Operations Impact on Water

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
All	Minor	Negligible

9.3.4.3 Operational Leaks and Spills

Small scale spillages and leakages may occur throughout the project phases, however, rig design incorporates leak minimisation and drainage containment systems to ensure that spillages do not enter the environment. All storage facilities will be contained within adequate bunding.

The majority of chemicals employed during drilling operations are related to drilling mud and described in Section 4.4.1.2.2. All chemicals utilised in the project were subject to strict vetting by ANPM as part of the import requirements, a comprehensive checklist was completed and approved by ANPM in May 2020, a full MSDS database is maintained. There is an inherent potential for spillage and consequent leakage into the environment, however, proper storage, rig design, handling and operating procedures will be incorporated, hence, the risk of impact from chemical and hazardous materials can be minimised. The potential for impact given proper facilities and design and good operating practice is considered minimal.

All chemicals and fuel on site will be stored in bunded impermeable areas with adequate shading. Correct storage, handling, use and transportation of chemicals will be followed according to manufacturer's specifications, material safety data sheets and regulations.

A Hazardous Substance SOP will be developed to provide a complete framework for chemicals management in compliance with company rules and national standards. There will be no disposal of unused chemicals, all excess materials will be quantified and recorded and returned to the vendors.

Contaminated materials treatment and disposal are addressed in the EMP Appendix A - Waste Management Plan, and contingency plans will be prepared to assess and prepare for all spill risks and a separate, site specific oil spill contingency plan is presented in Appendix D.

9.3.4.3.1 Leaks and Spills Impact Significance

Table 9-25. Significance Impact from Leaks and Spills

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	The potential impact may affect 5 km or more around the site.	4
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	2
Intensity - Environmental	Medium	3	Potential spills may affect a larger area beyond the site, once they come into contact with runoff or storm water. Where the affected environment is altered but natural functions and processes continue, albeit in a modified way	6
Intensity - Social/Cultural/ Economic	Low	2	Affecting a small number of Individuals/households, communities or Sucos, small enterprises.	4
Likelihood	Probable	2	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Moderate**	**4**

9.3.4.3.2 Mitigation Measures - Leaks and Spills

- Rig design incorporates leak minimisation and drainage containment systems to ensure that spillages do not enter the environment.
- All chemicals and fuel on site will be stored in bunded impermeable areas with adequate shading.
- Correct storage, handling, use and transportation of chemicals will be followed according to manufacturer's specifications, material safety data sheets and regulations.
- Provide a Hazardous Substance SOP for chemicals management in compliance with company rules and national standards.
- No disposal of unused chemicals, all excess materials will be quantified and recorded and returned to the vendors.
- Prepare spill contingency plans.

9.3.4.3.3 Residual Impact - Leaks and Spills

The project is limited spatially to the drilling location and immediate surrounds and is short term and transient in nature, any potential impacts are inconsequential. The implementation of the mitigation measures will contribute to reducing the significance of the residual impact associated with the Impact from Leaks and Spills to **Negligible**.

Table 9-26. Pre and Post Mitigation Significance: Impact from Leaks and Spills

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
All	Minor	Negligible

9.3.4.4 Worst Case Oil Spill Scenario

If hydrocarbons are discovered there is a possibility that a larger scale well-related incident may occur, and best industry practice requires a worst case scenario is addressed. Such events are rare, however, contingency plans will be prepared to assess and prepare for such an eventuality. In Timor-Leste four uncontrolled flows have been reported; Aliambata (oil and gas 1916), Matai-1 (water 1960), Tafara East-1 (water 1969) and Suai Loro-2 (gas 1971), all were minor and did not involve injury or significant environmental damage.

The major risk potential is related to loss of well control (i.e. well blowout) and an oil spill contingency plan is prepared for such a scenario (See EMP Appendix D). In the case of an oil spill, arrangements are in place with local contractors for heavy plant, equipment and labour. Timor Resources has adopted best practices approach to preventing a situation where reactive measures such as surface or Relief Well intervention are required. However, since all potential scenarios need to be considered, have planned for intervention as a worst-case, and Wild Well Control Limited are nominated well control specialists.

TR carries requisite insurance including, but not limited to, Control of Well Insurance, Redrilling/Extra Expense Insurance, Seepage and Pollution, Cleanup and Contamination Insurance.

9.3.4.4.1 Worst Case Oil Spill Impact Significance

Table 9-27. Significance Impact from Worst Case Oil Spill

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	National	4	Impact that extends far beyond the site boundary; widespread effect	8
Duration	Long-term	3	Impact that lasts 16-30 years	6
Intensity - Environmental	High	4	Where natural functions or processes are altered to the extent that they will temporary or permanently cease.	8
Intensity - Social/Cultural/ Economic	High	4	Affecting a large number of Individuals/households, communities, Sucos, PA or Municipality, large enterprises	8
Likelihood	Probable	2	Possibility that the impact may materialise chance of occurrence >10%	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Major**	**8**

NOTE: whilst the impact significance shown above indicates a Moderate impact, for assessment purposes at a local level the impact could be considered as Major for assessment purposes.

9.3.4.4.2 Mitigation Measures - Worst Case Oil Spill

- Detailed well design aimed at prevention of any loss of control during drilling.
- Preventative measures and equipment integral in well design, including drilling fluids (mud) and blow-out preventer, well control procedures. See Project Safety Case.
- Prepare oil spill contingency plan.

9.3.4.4.3 Residual Impact - Worst Case Oil Spill

The implementation of the mitigation measures will contribute to reducing the significance of the residual impact associated with the impact of a worst case oil spill but still remains **Moderate**.

Table 9-28. Pre and Post Mitigation Significance: Impact from Leaks and Spills

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
All	Major	Moderate

9.3.4.5 Water Supply

Daily water needs for drilling are estimated to be up to 60,000 litres per day. Prior to the start of the drilling it is estimated that a water volume of 50,000 litres will be stored in the tanks and pits on site. During ongoing drilling operations, the estimated additional requirement is 10,000L - 20,000L per day depending on the operation.

Water will be sourced from local contractors in Same that are capable to supply the volume of water required for consumption for Rusa-1. Same is one of the places in East Timor with abundance of water year round. The level of offtake from the water source will be such that it is not detrimental to the supply for other users.

For camp use it is estimated to allow 100L per person per day, thus with a total crew of 70 people in both camps the daily requirement is an additional 7000L. Water source is from a water well at the Betano camp.

Project activities will not compromise the availability of water for the local communities.

9.3.4.5.1 Water Supply Impact Significance

Table 9-29. Significance Impact on Water Supply

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	The potential impact may affect 5 km or more around the site.	2
Duration	Short-term	1	Any impact is quickly reversible to normal levels post decommissioning.	1
Intensity - Environmental	Low	2	The impact affects the environment in such a way that natural functions and processes are not affected	2
Intensity - Social/Cultural/ Economic	Low	2	Affecting small number of Individuals/ households, communities, Sucos.	2
Likelihood	Not Probable	1	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Negligible**	**2**

9.3.4.5.2 Mitigation Measures - Water Supply

- Procure adequate water for the operations with a high yield.
- Ensure no water use competition with the local community.

9.3.4.5.3 Residual Impact - Impact on Water Supply

The implementation of the mitigation measures will contribute to reducing the significance of the residual impact associated with the Impact on Water Supply to **Negligible**.

Table 9-30. Pre and Post Mitigation Significance: Impact on Water Supply

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
Decommissioning	Negligible	Negligible

9.3.5 Biodiversity, Flora and Fauna

Biodiversity, Flora and Fauna impacts if present will mainly occur during construction phase and decommissioning with the removal of project facilities and rehabilitation. Little or no reduction in wildlife habitat would be expected as the areas concerned are small and the project is of short duration.

Loss of flora and/or fauna is of great concern in any project. Disturbance to land and soils can cause changes to the flora and fauna communities, however, there will be little or no impact on the ecology, and disturbance is limited since the locations have been selected to avoid sensitive habitats, to identify, where possible, previously disturbed land and to keep footprint to a minimum, see location map and site description in Section 4.4.3.

Animal populations may be affected by changes in vegetation, soil, water and noise levels arising from these operations, such as:

- Displacement in the immediate vicinity
- Habitat disturbance
- Direct habitat loss and modification
- Blockage of access to habitats

Habitat disturbance could include vegetation or soil removal, erosion, changes in soil structure, changes in topography and hydrology. Access to habitats can be blocked by the construction of the access road and well pad.

In regard to biodiversity, it is important to consider, to the extent possible on the basis of existing knowledge:

- Rate of extinction occurring and likely to occur
- Minimum sustainable gene pools and population size
- Dynamics of ecosystems that support threatened or endangered species
- Status, distribution and vulnerability of individual species
- Regional differences in extinction rates.

With regard to the effect of noise on bird life this is addressed in Section 6.2.6 and in the noise impact discussion in Section 9.3.7 below, which provides a conclusion that the oil well drilling activities will not cause significant negative impact to identified bird species within well site because distribution of those bird species are categorised widespread residence, which means they can live, hide and feed in types of places such as tropical forest, woods, plantations and among community residence. Therefore, those bird species can move out to other location when drilling activities are being carried out.

In considering these aspects it should be borne in mind the spatial and temporal aspects of this project, the minimal areal extent of the project is minimal, and the project is considered short term and transient thus no biodiversity impacts are envisaged.

9.3.5.1 Biodiversity, Flora and Fauna Impact Significance

Table 9-31. Significance Impact on Biodiversity, Flora and Fauna

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	Impacts that extends beyond the site boundary; affects the immediate surrounding environment (i.e. up to 5 km from Project Site Boundary)	6
Duration	Short-term	1	Impact that is quickly reversible; 0-5 years	3
Intensity - Environmental	Low	2	Although plant species will be temporarily impacted, they can be replanted during rehabilitation. There are no biodiversity aspects. The intensity is low since the vegetation in most of the areas is already disturbed from previous human activities. The impact affects the environment in such a way that natural functions and processes are not affected	6
Intensity - Social/Cultural/ Economic	Low	2	Affecting a small number of Individuals/households, communities or Sucos, small enterprises.	6
Likelihood	Highly Probable	3	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Minor**	**5**

9.3.5.2 Mitigation Measures - Biodiversity, Flora and Fauna

- Education on the importance of flora and fauna in the areas, including the appropriate regulatory requirements
- Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the reestablishment of plant cover is desirable to prevent erosion if it was necessary.
- Implement a tree planting program to offset loss of trees due to the construction phase
- Clearing vegetation only in construction areas and demarcating areas where no clearing will happen.
- Vehicles coming into the site must use designated roads.

- Apply spill prevention practices and response actions in refuelling and vehicle-use areas to minimise accidental contamination of habitats.
- Address spills immediately per the appropriate spill management plan, and initiate soil clean-up and soil removal if needed.
- Turn off all unnecessary lighting at night to avoid disturbing wildlife and migratory birds.
- Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance.
- Schedule decommissioning activities to avoid disturbance of resources during critical periods, for example at night, or year, for example breeding, nesting seasons.
- Rehabilitate all the areas of disturbed soil using weed free native grasses and shrubs.
- Undertake rehabilitation activities as early as possible on disturbed areas in consultation with the relevant authorities, e.g. Forestry Department.
- Timor Resources and Direção Geral das Florestas Cafe e Plantas Industriais should to work together to find a solution for deforestation to grow plants in area affected by drilling activities.

9.3.5.3 Residual Impact - Biodiversity, Flora and Fauna

Given that the project is limited spatially to the drilling location and immediate surrounds and is short term and transient in nature, any potential impacts are insignificant. The implementation of the mitigation measures will contribute to reducing the significance of the residual impact associated with the loss of Biodiversity, Flora and Fauna to **Negligible**.

Table 9-32. Pre and Post Mitigation Significance: Impact on Biodiversity

Phase	Significance (Pre-mitigation)	Residual Impact Significance
All	Minor	Negligible

9.3.6 Waste

9.3.6.1 Liquid Effluents

Liquid wastes will arise from a variety of sources and mitigation measures are described here.

Liquid wastes sources include rainwater, firewater, washdown water and leaks and minor spillages in the hazardous area of the rig. Open drains on the rig floor will collect any oily residues and discharge to the mud pit. The well site incorporates two mud pits each with a volume of approximately 334 m^3 (2,100 bbls), a freeboard of 0.5m and lined with a High-Density Polyethylene (HDPE) membrane liner.

Berms are constructed around the location for containment and management of surface water which is directed to a perimeter drainage ditch. The perimeter drain is routed to an interceptor where oil is periodically collected and discharged to the mud pit, clean water from the interceptor is discharged offsite.

Sewage will be collected and treated in a standard field septic system and the effluent discharged under the ground surface through a trickle feed weeping tile to a leach field.

9.3.6.1.1 Liquid Effluents Impact Significance

Table 9-33. Significance Impact of Liquid Effluents

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	Impacts that extends beyond the site boundary; affects the immediate surrounding environment (i.e. up to 5 km from Project Site Boundary)	8
Duration	Short-term	1	Impact that is quickly reversible; 0-5 years	4
Intensity - Environmental	Low	2	The impact affects the environment in such a way that natural functions and processes are not affected	8
Intensity - Social/Cultural/ Economic	Low	2	Affecting a small number of Individuals/households, communities or Sucos, small enterprises.	8
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Minor**	**7**

9.3.6.1.2 Mitigation Measures - Liquid Effluents

- Open drains on the rig floor will collect any oily residues and discharge to the mud pit.
- Rainwater is routed via the perimeter drain to an interceptor where oil is separated.
- Sewage will be collected and treated in a standard field septic system and the effluent discharged to the ground through a trickle feed weeping tile to a leach field.
- The drilling rig will have a test separator to process any produced fluid from well testing operations. Any produced liquids will be stored in tanks and transported to existing facilities for processing.
- Compliance with Municipality on waste matters.
- Employing a waste management plan.

9.3.6.1.3 Residual Impact - Liquid Effluents

The project is limited spatially to the drilling location and immediate surrounds and is short term and transient in nature, the implementation of the mitigation measures will contribute to reducing the significance of the residual impact of liquid effluents, however, to ensure adequate management the residual impact remains **Minor**.

Table 9-34. Pre and Post Mitigation Significance: Impact of Liquid Effluents

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
All	Minor	Minor

9.3.6.2 Solid Wastes

Solid wastes generated during normal drilling operations comprise dry domestic wastes, industrial organic wastes, and industrial inorganic wastes. An area at rig site will be used for temporary storage of wastes prior to transfer to the designated waste reception facility assigned for the campaign near to Haemanu yard, where wastes will be segregated and managed as discussed below.

There will be no Naturally Occurring Radioactive Material (NORM) produced during the drilling campaign. NORM is a product in production operations and not in exploration drilling.

Cuttings: cuttings volumes are calculated by multiplying the cross-sectional area (πr^2) of each of the well sections (see Section 4.4.1) by the depth of the well. There are two options for the Rusa-1 total well depth, either 2,601m or 3,936 m depending on the results of the geological assessment. Thus cuttings will be in the region 500 m^3 to 600m^3.

As described in Section 4.1 the drill cuttings will be conveyed to the surface via the riser to be treated in the solids treatment system. The solid treatment system will consist of shaleshaker, desander, mud cleaner and centrifuge. A partially closed loop system is operated that reduces the need for multiple pits, hence the pits are smaller because the storage volumes are less. This, together with high efficiency solids control equipment, minimises the amount of residual fluid on drilled cuttings with the excess fluids discharged to the pit.

Options for the disposal of cuttings are described in Section 8.5.1 and the preferred option is encapsulation on site which represents an environmental impact significance as "none" (see Table 9-2) and is preferred when compared with the potential impacts identified with other options.

Waste mud in the region of 200m^3 to 400 m^3 will arise from the well. The initial planning process led to the following decisions:

- The geological/geochemical assessments demonstrate that water-based muds are effective in this well.
- Recycling of re-usable drilling fluid and removal of solid drilling waste at the rig-site will be maximised by optimised operation of solids separation.
- Any fluid recycled on the rig site will be as make up for new mud provided it conforms to required properties for acceptable drilling. If deemed not required, fluid will be stored for use on the next well.

Dry domestic wastes typically comprise general hotel management type wastes from the camp such as paper, disposable cups, food waste, packaging etc. During the drilling project typical waste arising of 5 tonnes per week will occur, however, given the short duration of the drilling program the volumes of waste arising are considered negligible. All dry domestic wastes will be incinerated at the designated waste site.

Industrial Organic Wastes include paper, wood, oily rags, non-metallic oil filters, absorbent pads, plastic wraps, packing materials, sludges and various small amounts of other flammable materials. All industrial organic wastes will be incinerated.

Small amounts of the solid industrial waste produced will require special care. Therefore, oily wastes, e.g. rags, absorbent materials etc. and hazardous material (chemicals) will be segregated at source for batch incineration at the designated waste facility.

Unused chemicals will be stored onsite for future use or returned to the vendors.

Industrial Inorganic Wastes arisings from normal operations will include discarded wire, scrap metals, paint and thinner, rags, cans, plastics, spent filtration cartridges, chemical drums, metallic filters, glass items and batteries. Once again typical amounts that will require disposal will be small, less than a tonne for the full project. Industrial inorganic wastes will be disposed of via local facilities for scrap metals and special wastes (e.g. batteries, used drums etc.). Wastes will be segregated onsite before reclamation.

Medical waste will be properly stored in bio-hazard medical waste containers and managed by the rig medic, arrangements have been made to dispose of the small levels of medical waste at the Suai hospital.

9.3.6.2.1 Solid Waste Impact Significance

Table 9-35. Significance Impact of Solid Wastes

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment depending on treatment/ disposal method

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	Impacts that extends beyond the site boundary; affects the immediate surrounding environment (i.e. up to 5 km from Project Site Boundary)	8
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	4
Intensity - Environmental	Medium	3	Where the affected environment is altered e.g. emissions from incineration, but natural functions and processes continue, albeit in a modified way.	12
Intensity - Social/Cultural/ Economic	Low	2	Affecting more Individuals/ households, communities, Sucos or Post Administrative, medium enterprises.	8
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Minor**	**8**

9.3.6.2.2 Mitigation Measures - Solid Waste

- Work in concert with the Municipalities to develop and implement a fit for purpose waste management plan.
- Assessing and creating opportunities for Reducing, Reusing, and Recycling of waste.
- Municipality making available suitable facilities for the collection, segregation, storage and safe disposal of the wastes.
- Creating waste collection areas for segregation of waste with clearly marked facilities such as colour coded bins. The bins to be coded according to biodegradable and non-biodegradable, reuse, recycling and reduce.

9.3.6.2.3 Residual Impact - Solid Waste

The volumes of waste arisings are small when considering the short nature of the project and with the implementation of implementation of the mitigation measures together with robust waste management (See EMP Appendix A - Waste Management Plan), the significance of the residual impact associated with solid wastes are **Minor**.

Table 9-36. Pre and Post Mitigation Significance: Impact of Solid Waste

PHASE	SIGNIFICANCE (PRE-MITIGATION)	RESIDUAL IMPACT SIGNIFICANCE
All	Minor	Minor

9.3.7 Noise

Noise can potentially pose a problem if disturbance is caused to wildlife or human inhabitants close to the operation. Noise will arise throughout the project during construction, operations and decommissioning, however, in mitigation, any noisy equipment will be acoustically clad to minimise potential impacts.

The areal extent of noise impact is subject to several influencing factors such as temperature, humidity and wind speed and direction. However, to assess the potential impact of noise on the surrounding communities, the attenuation distance of noise level in air was calculated.

The expected levels of noise during operations are presented below and will be in the region of 40-60 dB(A) at the perimeter fence falling to 30-40 dB(A) 350m from the rig (see noise attenuation maps for the well site, Figure 9-3 , Betano camp Figure 9-4 and Haemanu yard Figure 9-5). Noise levels should not exceed the levels presented in the IFC Guidelines (Table 9-38) or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site (see sensitive receptors Table 6-3 and Figure 6-30) for any sustained length of time. Background noise levels were recorded during the project baseline survey and results are within the WHO guideline range (see Section 6.1.4.3).

The actual noise levels will be less than calculated where intervening infrastructure and vegetation are located between the source and monitoring location. The type of walls of dwellings, for instance brick or wood, will also impact noise levels. Sound level units are quoted in total decibels (dB) or decibels within the human audible frequency spectrum (dBA).

The typical sound levels for rig components and locations are shown below (from (Radtke, 2016), (Abadi et al, 2015) & (SLR Consulting, 2011)). The actual sound levels during the operation will be subject to the type of activity being conducted (e.g. drilling, tripping, circulating).

Table 9-37. Typical Noise Levels Emitted by Rig Equipment

SOUND LEVEL (DBA)	TYPICAL SOURCE	SUBJECTIVE EVALUATION
130	N/A	Intolerable without PPE
100-120	Engine Generators, Desander / Desilter	Extremely Noisy
80-100	Mud Pumps, Compressors, Shakers	Very Noisy
60-80	Rig noise in camp offices	Loud
40-60	Rig Noise at site perimeter	Moderate to Loud
30-40	Rig Noise 350 m from Source	Quiet
20-30	Rig Shut down, background	Almost Silent – Very Quiet

The percentage drop in sound level with distance from source was calculated using Free Field Inverse Square Law. Using dB2=dB1+10ln(d1/d2) where dB2 is the sound level at a given point at a distance of d2 from the sound level dB1 at a distance of d1 from the source. For the purpose of this calculation a sound level of 80dB 1m from the source was used and plotted on the 350 m extent map for the Rusa-1 wellsite (Figure 9-2).

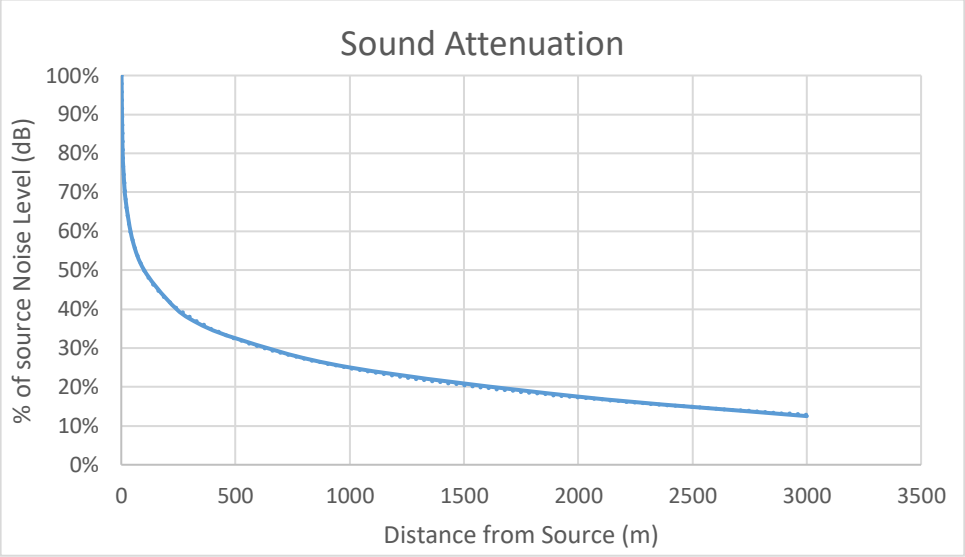


Figure 9-2. Attenuation Rate of Sound Level in Air

Currently there are no specific environmental assessment standards or legislation addressing noise in Timor-Leste so World Bank standards are considered as per IFC Guidelines, see Table 9-38 .

Table 9-38. Noise Level Guidelines
(Source: WHO Guidelines for Community Noise - Berglund et al. 1999)

NOISE LEVEL GUIDELINES		
	One Hour L_{Aeq} (dBA)	
Receptor	**Daytime 07:00 - 22:00**	**Night time 22:00 - 07:00**
Residential; institutional; educational	55	45
Industrial; commercial	70	70

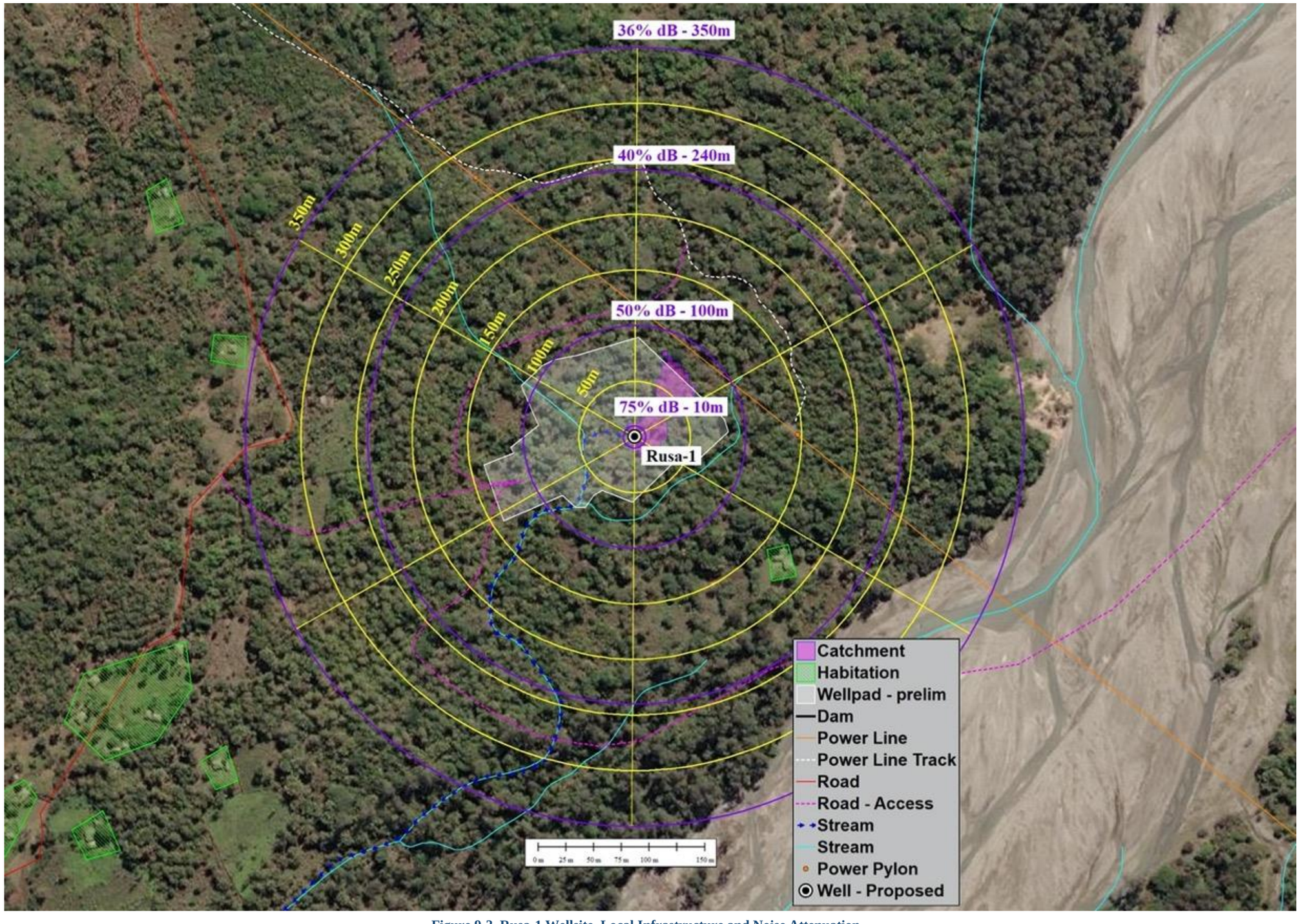


Figure 9-3. Rusa-1 Wellsite, Local Infrastructure and Noise Attenuation

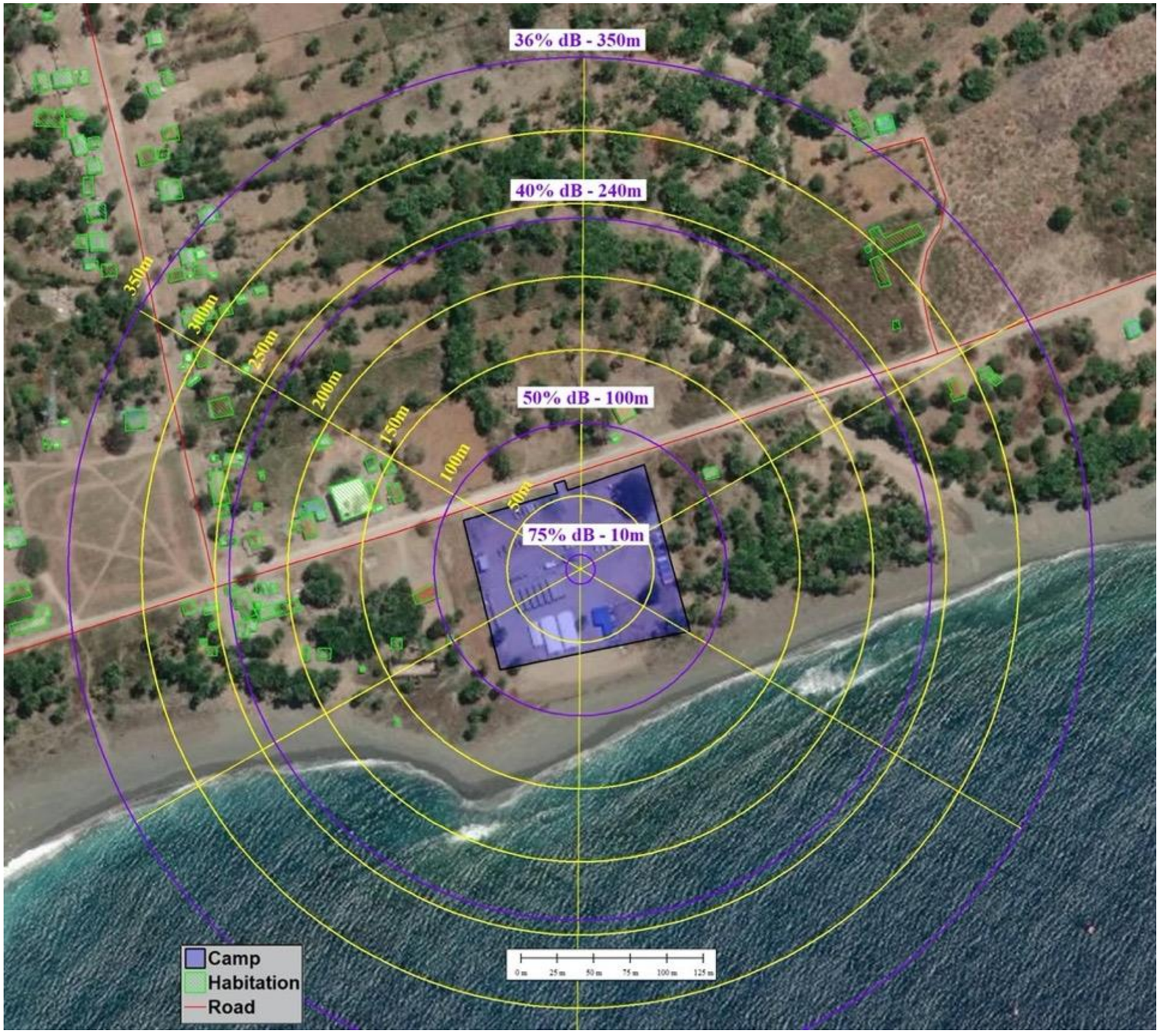


Figure 9-4. Betano Base Camp, Local Infrastructure and Noise Attenuation

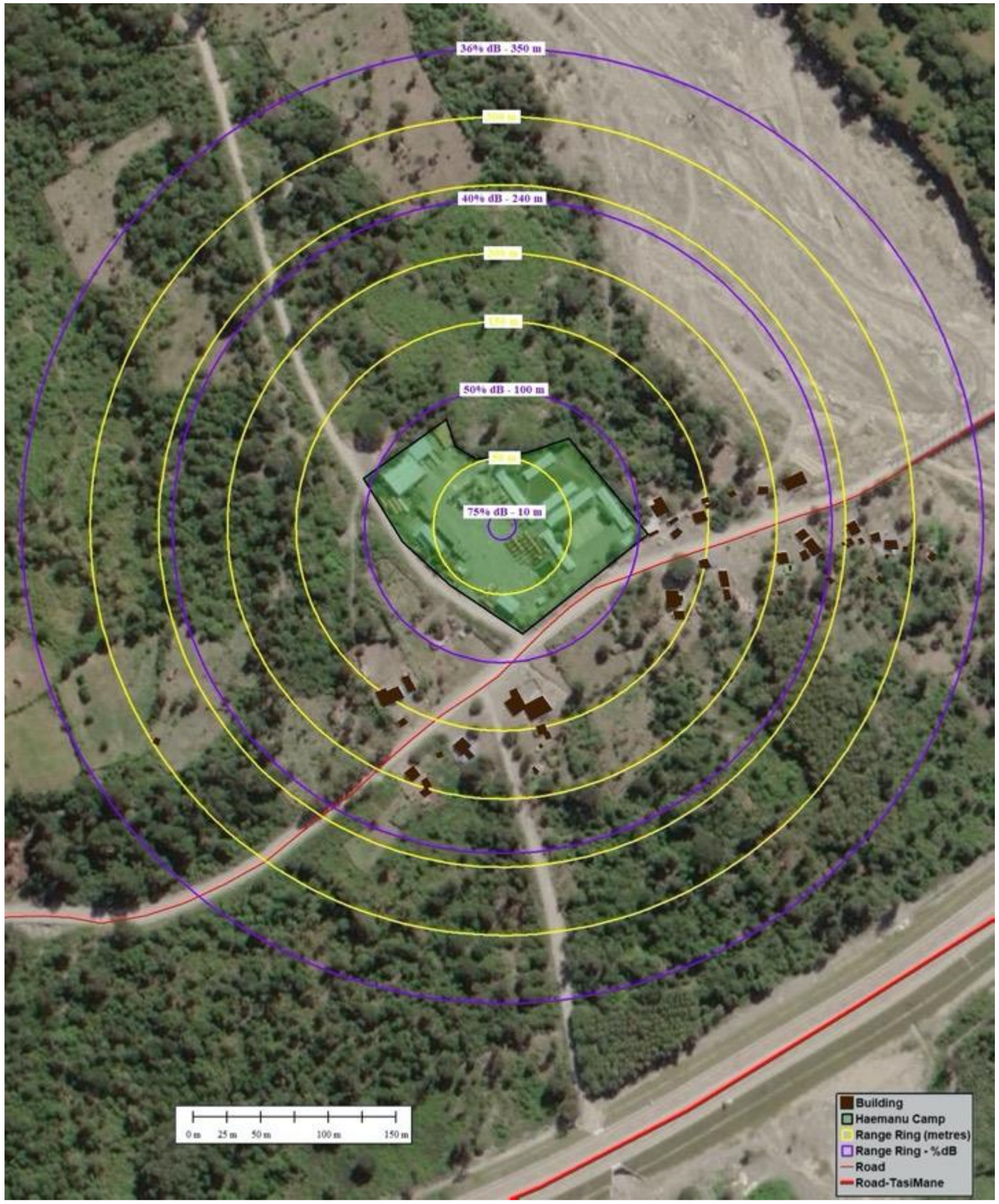


Figure 9-5. Haemanu Supply Base, Infrastructure and Noise Attenuation

9.3.7.1 Noise - Construction

During the construction phase of the proposed project, there is expected to be an increase in the noise levels within the area due to machinery and equipment including generators, vehicular traffic, and other construction activities. These may contribute to noise levels above the background within the site and along the roads to the site.

9.3.7.1.1 Noise Impact Significance - Construction

Table 9-39. Construction Significance Impact from Noise

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct cost to the receiving environment

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	The potential impact may affect 5 km or more around the site.	8
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	4
Intensity - Environmental	Low	2	The impact affects the environment in such a way that natural functions and processes are not affected	8
Intensity - Social/Cultural/ Economic	Low	2	Affecting a small number of Individuals/households, communities or Sucos, small enterprises.	8
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Minor**	**7**

9.3.7.1.2 Mitigation Measures - Construction Noise

- Restrict construction activities to normal working hours 0800hrs to1700hrs
- Inform local residents beforehand, via notices and advisories, of pending noisy periods and solicit their tolerance well before the commencement of demolition works.
- Machinery should be maintained regularly to reduce noise resulting from friction during operations.
- Drivers to adhere to speed limits within the project site access roads and vicinity
- A grievance procedure will be established whereby noise complaints by neighbours are recorded and responded to.
- Restrict hooting of vehicular horns.
- Locate all stationary construction equipment (i.e., compressors and generators) as far as practicable from any nearby sensitive receptors.
- Shielding the area to reduce noise propagation as necessary.

9.3.7.1.3 Residual Impact - Construction Noise

The implementation of the construction mitigation measures will contribute to reducing the significance of the residual impact associated with Noise Pollution to **Negligible**.

Table 9-40. Pre and Post Mitigation Significance: Construction Impact from Noise Pollution

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
Noise Construction	Minor	Minor

9.3.7.2 Noise - Operations

Drilling operations produce limited noise from drilling machinery and vehicular movement.

9.3.7.2.1 Noise Impact Significance - Operations

Table 9-41. Operations Significance Impact from Noise

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Impacts will directly affect those who are within the project site.

Criteria	Ranking		Description	Impact Significance
Extent	Site Specific	1	The potential impact may affect 5 km or more around the site.	4
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	4
Intensity - Environmental	Low	2	The impact affects the environment in such a way that natural functions and processes are not affected	8
Intensity - Social/Cultural/ Economic	Low	2	Affecting a small number of Individuals/households, communities or Sucos, small enterprises.	8
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Minor**	**6**

9.3.7.2.2 Mitigation Measures: Operations Noise

- Machinery should be maintained regularly to reduce noise resulting from friction during operations.
- A grievance procedure will be established whereby noise complaints by neighbours are recorded and responded to.
- Muffle and maintain all equipment used.
- Using modern machinery equipment with noise suppressing technologies in order to reduce the noise-rating as much as possible.

9.3.7.2.3 Residual Impact - Operations Noise

The implementation of the operation mitigation measures will contribute to reducing the significance of the residual impact associated with noise but impact remains **Minor**.

Table 9-42. Pre and Post Mitigation Significance: Operations Impact from Noise Pollution

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
Noise Operations	Minor	Minor

9.3.7.3 Noise - Decommissioning

There is expected to be an increase in the noise levels due to machinery/ equipment including generators, metal grinders, vehicular traffic, and other activities. As with the construction phase elevated noise levels within the site can affect workers and near-by residents, passers-by and other persons within the vicinity of the site.

9.3.7.3.1 Noise Impact Significance - Decommissioning

Table 9-43. Decommissioning Significance Impact from Noise

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Impacts will directly affect those who are within the project site.

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	The potential impact may affect 5 km or more around the site.	8
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	4
Intensity - Environmental	Low	2	The impact affects the environment in such a way that natural functions and processes are not affected	8
Intensity - Social/Cultural/ Economic	Low	2	Affecting a small number of Individuals/households, communities or Sucos, small enterprises.	8
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Minor**	**7**

9.3.7.3.2 Mitigation Measures - Decommissioning Noise

- Restrict decommissioning activities to normal working hours 0800hrs to1700hrs
- Inform local residents beforehand, via notices and advisories, of pending noisy periods and solicit their tolerance well before the commencement of demolition works.
- Machinery should be maintained regularly to reduce noise resulting from friction during operations.
- Drivers to adhere to speed limits within the project site access roads and vicinity
- A grievance procedure will be established whereby noise complaints by neighbours are recorded and responded to.
- Restrict hooting of vehicular horns.
- Locate all stationary equipment (i.e., compressors and generators) as far as practicable from any nearby sensitive receptors.
- Limit pick-up trucks and other small equipment to an idling time, observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.
- Shielding the area to reduce noise propagation as necessary.

9.3.7.3.3 Residual Impact - Decommissioning Noise

The implementation of the decommissioning mitigation measures will contribute to reducing the significance of the residual impact associated with the Impact on Noise to **Negligible**.

Table 9-44. Pre and Post Mitigation Significance: Decommissioning Impact from Noise Pollution

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
Noise Decommissioning	Minor	Negligible

9.3.8 Light, Odours and Heat

Light: The rig site will be illuminated during night-time to ensure adequate visibility for work to proceed safely and the perimeter fence illuminated for security purposes, hence the main cause of concern will be excessive light during hours of darkness. Extraneous light may cause problems for humans and wildlife, but since there are no people or sensitive biological assemblages in the immediate vicinity of the well site and the project is limited spatially to one-hectare, is short term and transient in nature, impacts are negligible.

Odours: There are no direct sources of odour from the drilling activities. However, if hydrocarbons are discovered small amounts of vapours may be released during normal operations. There is a low potential to encounter H_2S, if so, an odour nuisance may arise. The normal criteria for H_2S odour nuisance is 3 minute average ground level of 0.5 ppb of H_2S. As with light, the project is limited spatially to the one-hectare drilling location and its immediate surrounds, and is short term and transient in nature, potential impacts are negligible.

Heat : There are no direct heat sources that will extend outside of the perimeter fence.

9.3.8.1 Light, Odours and Heat Impact Significance

Table 9-45. Significance Impact from Light

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Impacts will directly affect those who are within the project site.

Criteria	Ranking		Description	Impact Significance
Extent	Site Specific	1	The potential impact is limited to the boundaries of the project site.	4
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	4
Intensity - Environmental	Low	2	The impact affects the environment in such a way that natural functions and processes are not affected	8
Intensity - Social/Cultural/ Economic	None	1	Affecting a small number of Individuals/ households/individual enterprises.	4
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Minor**	**5**

9.3.8.2 Mitigation Measures Light

- The site occupies a small area will be in place temporarily.
- Any important sensitivity in the project areas (e.g. infrastructures, areas of significant vegetation cover, sensitive cultivations, important sites for cultural heritage, etc.) will be identified and avoided as appropriate.
- Use a lower level of lighting i.e. sufficient to enhance the night-time visibility required for safety and security
- Use specifically designed lighting equipment that minimises the upward spread of light near to and above the horizontal.
- Shading floodlights to only shine inside the site perimeter
- Turn off all unnecessary lighting at night to avoid disturbing wildlife and migratory birds.

9.3.8.2.1 Residual Impact - Light

Given that the project is limited spatially to the drilling location and immediate surrounds and is short term and transient in nature, any potential impacts in regard to light are inconsequential, and the implementation of mitigation measures will contribute to reducing the significance of the residual impact to **Negligible**.

Table 9-46. Pre and Post Mitigation Significance: Impact from Light Pollution Residual

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
Light	Minor	Negligible

9.3.9 Community

The project will cause various interactions with the local community through all phases, most are addressed in the previous sections such as: positive impacts related to employment, local services and community programs; whilst environmentally related negative impacts were addressed associated with land use, traffic, air quality and noise.

Other potential impacts on the local community relate to safety issues and the requirement for the local population to be made aware of various operational hazards, such as road safety, keeping a safe distance from the well site, and understanding hazards. Various programs will be established to ensure the community are aware of hazards and emergency plans, in addition, a complaints/grievance mechanism will be established to ensure an open, two-way dialogue. The Community is an integral part of Timor Resources management of the project and understanding perceptions, expectations and concerns are central to the process.

Timor Resources have been involved in community engagement since award of PSC 09 and in particular during the 2019 seismic campaign.

9.3.9.1 Community Impact Significance

Table 9-47. Significance Impact on Community

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Negative and direct impact on the community

Criteria	Ranking		Description	Impact Significance
Extent	Local	2	Impacts that extends beyond the site boundary; affects the immediate surrounding environment (i.e. up to 5 km from Project Site Boundary)	8
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	4
Intensity - Environmental	Low	2	The impact on the environment is not detectable, therefore discount as a criterion	8
Intensity - Social/Cultural/ Economic	Medium	3	Affecting more Individuals/ households, communities, Sucos or Post Administrative, medium enterprises.	12
Likelihood	Definite	4	Impact will occur regardless of any prevention measures.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Minor**	**8**

9.3.9.2 Mitigation Measures - Community

- Consultation with the Municipality and liaison with community during the planning phase.
- Establish a robust, open, two way Complaints/Grievance Mechanism.
- Establishing emergency procedures and ensuring the community are aware and educated on following them and commensurate to the magnitude and type of risk.
- The work site will be fenced off to protect the general public from dangers associated with the drilling operations, including security in and around the site to control the movement of people.
- Placing visible and readable warning signs around the work site and access roads where there are exposures.
- Compliance with Timor Resource's local content policy that reflects the requirement to hire locally, including a transparent and accessible application and short-listing process of workers.
- Where possible, look into vocational training programs for the local workforce to promote development of skills required by the oil and gas industry.

9.3.9.3 Residual Impact - Community

The project is limited spatially to the drilling location and immediate surrounds and is short term and transient in nature, thus there is limited potential to cause permanent or significant impact on the local community. Close liaison will be established with the community and local authorities and a grievance and redress scheme will be implemented, however, the significance of the residual impact associated with the impact on the Community remains **Minor**.

Table 9-48. Pre and Post Mitigation Significance: Impact on Community

PHASE	SIGNIFICANCE (PRE-MITIGATION)	RESIDUAL IMPACT SIGNIFICANCE
All	Minor	Minor

9.3.10 Visual

Oil and gas activities may have negative impacts on visual resources that are valued by people who live in or use an area. Visual impacts may arise from the presence of the drilling facilities however, most are low level containerised units <5m in height, with only the drilling mast rising some 40m height above ground level.

After the 40 day drilling program, the rig will be removed and the site restored to its original condition or to an agreed after use, thus there will be no lasting visual impact as a result of the drilling activities.

If a discovery is made, a well head will be installed, but the rig will still be removed from the location. In this case a reduced area will be retained with the well head and fenced off for safety reasons, however the well head is unlikely to cause any visual impact.

9.3.10.1 Visual Intrusion Impact Significance

Table 9-49. Significance Impact from Visual Intrusion

Evaluation Criteria	Evaluation Ranking	Description
Nature	Negative, Direct	Impacts will directly affect those who are within the project site.

Criteria	Ranking		Description	Impact Significance
Extent	Site Specific	1	The potential impact is limited to the boundaries of the project site.	3
Duration	Short-term	1	Impacts will last during construction and operational phase but return to normal levels post decommissioning.	3
Intensity - Environmental	None	1	The impact on the environment is not detectable.	3
Intensity - Social/Cultural/ Economic	Low	2	Affecting a small number of Individuals/ households, communities or Sucos, small enterprises.	6
Likelihood	Highly Probable	3	It is expected the impact will occur, chance of occurrence 50-90%.	
OVERALL IMPACT SIGNIFICANCE RATING (PRE-MITIGATION)			**Negligible**	**4**

9.3.10.2 Mitigation Measures - Visual Intrusion

- The site occupies a small area and the drilling facilities will be in place temporarily.
- The project is limited spatially to the one-hectare drilling location and its immediate surrounds and is short term and transient in nature.
- Any important sensitivity in the project areas (e.g. infrastructure, areas of significant vegetation cover, sensitive cultivations, important sites for cultural heritage, etc.) will be identified and avoided as appropriate.

9.3.10.3 Residual Impact - Visual Intrusion

Since the project is limited spatially to the drilling location and immediate surrounds, is short term and transient in nature, any potential visual impacts are considered inconsequential, thus any impact on visual intrusion is **Negligible**.

Table 9-50. Pre and Post Mitigation Significance: Impact from Visual Intrusion Residual

Phase	Significance (Pre-Mitigation)	Residual Impact Significance
Visual Intrusion	Negligible	Negligible

9.3.11 Cumulative Impacts

The assessment of cumulative impacts aims to identify those environmental, social or health aspects that may or may not on their own constitute a significant impact but when combined with impacts from past, present or reasonably foreseeable future project activities or other projects/activities may result in a larger and more significant impact. IFC state "*Cumulative impacts may result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted*" (IFC 2012).

Timor Resources hold the licence for PSC TL-OT-17-09 and there is no other onshore oil and gas activity in the area or in the country. Furthermore, the scope of the other industries assessed were limited to mining and quarrying, agricultural activities, IT and service activities (see Section 6.3). On this basis there is little other comparable industrial activity to which this project would have a potential to contribute material cumulative impacts.

The exploration drilling phase is the second step in the oil and gas development cycle, after seismic. It is limited spatially to a one-hectare drilling location and its immediate surrounds thus is local in extent, short term in duration, transient in nature and considered a temporary activity with low risk of cumulative impacts. Cumulative impacts will be investigated in greater detail during any future production phase of the project.

9.4 Summary of A Preliminary Assessment of Impacts and Possible Mitigation Measures

Table 9-51 and Table 9-52 are based on a preliminary assessment of impacts and provide a summary of the potential impacts and possible mitigation measures to minimise and/or eliminate these impacts, the residual impact after application of the mitigation is shown in the right-hand column.

Table 9-51. Summary of Positive Impacts

NO	IMPACT	SCOPE
1.	**Employment**	**Construction** (Timorese labour component 88) There will be several employment opportunities during the construction phase for: community consultation, community liaiso officers, civil construction crews, civil engineers, concreters, heavy vehicle drivers, light vehicle drivers, supervisors, engineers, mechanics, electrician surveyors, labourers, accommodation manager, security, administration, accounting service, cooks, cleaners, security, geologists, administration, accounting, operations management, work team supervisors. **Operations** (Timorese labour component 114) Additional employment during the operations phase includes rig related labour, inclusive of drilling crew, derrickmen, roustabouts, company men, geologists, security, labourers, and crew. In addition, the following positions remain important: concreters, heavy vehicle drivers, light vehicle drivers, supervisors, engineers, mechanics, electricians, surveyors, labourers, accommodation manager, security, administration, accounting service, cooks, cleaners, administration, accounting, operations management, work team supervisors. **Decommissioning** (Timorese labour component 88) Company men, geologists, security, labourers, and crew. In addition, the following positions remain important: heavy vehicle drivers, light vehicle drivers, supervisors, engineers, mechanics, electricians, surveyors, labourers, accommodation manager, administration, accounting service, cooks, cleaners, administration, accounting, operations management, work team supervisors.
2.	**Procuring Goods and Services**	Procurement from Timorese owned and operated businesses in the contract area goods and services include but are not limited to; 1. Fresh Food and water 2. Accommodation Housing/Office Supply 3. Diesel Supply 4. Import Services for customs clearance 5. Rental of Heavy Equipment, trucks, cranes 6. Environmental Consultancy Engagement 7. Aggregate and rock base

NO	IMPACT	SCOPE
3.	**Customs Duties and Taxes**	The use and consumption of various specialist drilling materials, such as machinery, mud components, drill bits, etc. will attract taxes and customs duties, which will be payable to the government hence increasing government revenue while the cost of these materials will be payable directly to the producers.
4.	**Community Programs**	Timor Resources has implemented a number of community programs, including horticulture, gifted seeds, irrigation and financial support. The supply of irrigation and water infrastructure has been the focus of Company support during seismic and is continuing during the drilling campaign. Support for local sporting competitions, teams and local events is another community contribution. The sponsoring of the Manufahi Cup, the Tour de Dili, and the local community football and soccer federations. Infrastructure within the area is set to improve especially the roads leading to the site after improvement eases access of transportation. The roads to the site will also serve other residents who are set to benefit from this infrastructure development brought by the project.

Table 9-52. Summary of Negative Impacts and Mitigation

NO	IMPACT	IMPACT RATING	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT
1.	**Land Use** All Phases	**Minor** **5**	• Contact local stakeholders early in the process to identify sensitive land areas, land uses, issues, and local plans and any local regulations. • Site the project on previously disturbed land whenever possible. • Depending on the individual site, consider steps to minimise the amount of vehicular traffic and human activity. • Provide adequate public notice of planned activities. • Establish a rehabilitation plan that addresses both interim and final rehabilitation requirements and agree after-use if applicable. Ensure that interim rehabilitation of disturbed areas is conducted as soon as possible. • Compensate farmers for crop damage and restore compacted soils.	**Minor**
2.	**Traffic** All Phases	**Moderate** **9**	• Plan to use existing roads to the maximum extent possible. • Prepare an access road siting study and management plan to guide road design and maintenance standards, coordinate closely with Municipality and national government authorities responsible for maintaining roadways and bridges. Compare the number, size, and weight of loads to service projects to the existing road infrastructure to determine if roads and bridges are adequate to support intended loads. • Implement strict traffic management procedures in association with the Municipality. • Route project traffic to minimise impacts on local communities. • Issue notices/advisories of pending traffic inconveniences and conduct briefing meetings with local authorities, schools and residents before the commencement of works. • Flagmen should be employed to control traffic and assist all vehicles as they enter and exit. • Maintain on site a record of incidents and accidents. • Ensuring that all drivers for the project understand and comply with speed limits. • Ensure all vehicles and machinery used for the project are in good working condition both legally and are fit for purpose.	**Minor**

NO	IMPACT	IMPACT RATING	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT
			• Control dust along un-surfaced roads, especially near residences, schools and fields. • Limit all traffic movement through villages in particular school opening and closing times.	
3.	**Soil** All Phases	**Minor 7**	**Construction** • Restricting removal of vegetation and soil cover to those areas necessary for the project. • Remove all topsoil and store off site. • Manage storm and flood flash water effectively to avoid movement of loss soils. • The disturbed areas should be rehabilitated with indigenous vegetation as soon as possible to prevent soil erosion if it was necessary. • Work areas should be clearly defined and demarcated, where necessary to avoid unnecessary disturbance on areas outside the project footprint. • Preventing pollution of ground from servicing of vehicles and wastes by having a specific site for collection, sorting and transport of wastes. • Construction vehicles should remain on designated roads and should avoid off-site driving. • Compacting area with loose soils. **Decommissioning** • Soil originally removed in the construction phase and stored will be returned upon restoration of the drill site and access road if necessary. • Drains will be installed, and drainage patterns will be re-established to prevent erosion. • Well site and roads are either left to an agreed after-use or rehabilitated following drilling. If the well is successful, the area will be reduced to the minimum size necessary in discussion with the authorities and the landowner. • During restoration and rehabilitation of the well site and roads, the site will be ripped before returning of the stockpiled topsoil. • Soil profile and contours will be reinstated upon completions of decommissioning phase.	**Minor**
4.	**Air Quality** Construction	**Moderate 9**	• Sprinkling water on soil before excavation and periodically when operations are under way to prevent raising of dust.	**Minor**

NO	IMPACT	IMPACT RATING	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT
			• Use of low sulphur fossil fuel. • Controlling the speed and operation of construction vehicles; drivers should adhere to the speed limit of 20 km/hr on access roads and 40 km/hr blacktop. • Regular maintenance and services of machines and engines. • In order to control exhaust, educate and raise awareness of construction workers on emission reduction and on emissions that are likely to occur during the construction of the well pad and access roads leading to the site, the following measures shall be implemented during construction: - Vehicle idling time shall be minimised - Equipment shall be properly tuned and maintained. • To minimise air pollution due to dust emission or transport of waste materials during construction, the waste materials must be transported in covered vehicles especially if the route is through frequently used roads. • Workers in dusty areas on the site need to be issued with PPE such as, dust masks and safety goggles during dry and windy conditions. • Sensitise truck drivers to avoid unnecessary racing of machinery engines at loading, offloading sites, and parking areas and encourage them to keep the vehicle engines off at these points.	
5.	**Air Quality** Operations	**Minor 7**	• Sprinkling water on access roads to reduce dust. • Use of low sulphur fossil fuel. • Speed limit on access road 20 km/hr on access roads and 40 km/hr blacktop. • Regular maintenance and services of machines and engines. • In order to control exhaust, educate and raise awareness of drivers on emission reduction and on emissions that are likely to occur during operations, the following measures shall be implemented during construction: - Vehicle idling time shall be minimised - Equipment shall be properly tuned and maintained	**Minor**

NO	IMPACT	IMPACT RATING	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT
			• Sensitise truck drivers to avoid unnecessary racing of machinery engines at loading, offloading sites, and parking areas and encourage them to keep the vehicle engines off at these points.	
6.	**Air Quality** Decommissioning	**Moderate 9**	• Covering of all haulage vehicles carrying debris for dumping at approved sites. • Stockpiles of fine materials should be wetted or covered with tarpaulin during windy conditions. • Workers in dusty areas on the site should be issued with dust masks and safety goggles. • Using well maintained equipment and machines with efficient engines meaning low emissions. • Using dust screens.	**Minor**
7.	**Surface Water** All Phases	**Minor 4**	• Minimise the planned amount of land to be disturbed as much as possible by use of existing roads. • Identify and avoid unstable slopes and local factors that can cause slope instability (groundwater conditions, precipitation, seismic activity, slope angles, and geologic structure). • Construct drainage ditches only where necessary. Use appropriate structures at culvert outlets to prevent erosion. • Refuel in a designated fuelling area that includes a temporary berm to limit the spread of any spill. • Refuel in a designated fuelling area that includes a temporary berm to limit the spread of any spill. • Closely monitor construction near aquifer recharge areas to reduce potential contamination of the aquifer; • Any discharge of grey water should be treated first to avoid contaminating water sources. • Upon completion of the decommissioning phase, disturbed areas will be contoured and vegetated to minimise the potential for soil erosion and water quality related impacts. • Temporary sediment and erosion control measures such as sediment fences installed where necessary especially in areas in close proximity to drains or surface water features to avoid runoff to water source.	**Negligible**

NO	IMPACT	IMPACT RATING	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT
			• Any area artificially elevated via pad or access track construction will be lowered to original ground level by removal of paving material unless otherwise instructed by the landowners. • Original drainage patterns will be restored.	
8.	**Groundwater** All Phases	**Minor 5**	• The regional deepest known freshwater is at 84 m and will be cased off before drilling continues. • Mud chemicals are non-toxic with the exception of biocide, but this is used in low quantities.	**Negligible**
9.	**Operational Leaks and Spills** All Phases	**Minor 4**	• Rig design incorporates leak minimisation and drainage containment systems to ensure that spillages do not enter the environment. • All chemicals and fuel on site will be stored in bunded impermeable areas with adequate shading. • Correct storage, handling, use and transportation of chemicals will be followed according to manufacturer's specifications, material safety data sheets and regulations. • Provide a Hazardous Substance SOP for chemicals management in compliance with company rules and national standards. • No disposal of unused chemicals, all excess materials will be quantified and recorded and returned to the vendors. • Prepare spill contingency plans.	**Negligible**
10.	**Worst Case Oil Spill** Operations	**Major 8**	• Detailed well design aimed at prevention of any loss of control during drilling. • Preventative measures and equipment integral in well design, including drilling fluids (mud) and blow-out preventer, well control procedures. See Project Safety Case. • Prepare oil spill contingency plan.	**Moderate**
11.	**Water Supply** All Phases	**Negligible 2**	• Procure adequate water for the operations with a high yield. • Ensure no water use competition with the local community.	**Negligible**

NO	IMPACT	IMPACT RATING	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT
12.	**Flora, Fauna and Habitat. Biodiversity** All Phases	**Minor 5**	• Education on the importance of flora and fauna in the areas, including the appropriate regulatory requirements • Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the reestablishment of plant cover is desirable to prevent erosion if it was necessary. • Implement a tree planting program to offset loss of trees due to the construction phase • Clearing vegetation only in construction areas and demarcating areas where no clearing will happen. • Vehicles coming into the site must use designated roads. • Apply spill prevention practices and response actions in refuelling and vehicle-use areas to minimize accidental contamination of habitats. • Address spills immediately per the appropriate spill management plan, and initiate soil clean-up and soil removal if needed. • Turn off all unnecessary lighting at night to avoid disturbing wildlife and migratory birds. • Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. • Schedule decommissioning activities to avoid disturbance of resources during critical periods, for example night, or year, for example breeding, nesting seasons. • Rehabilitate all the areas of disturbed soil using weed free native grasses and shrubs. • Undertake rehabilitation activities as early as possible on disturbed areas in consultation with the relevant authorities, e.g. Forestry Department.	**Negligible**
13.	**Liquid Effluents** All Phases	**Minor 7**	• Open drains on the rig floor will collect any oily residues and discharge to the mud pit. • Rainwater is routed via the perimeter drain to an interceptor where oil is separated. • Sewage will be collected and treated in a standard field septic system and the effluent discharged to the ground through a trickle feed weeping tile.	**Minor**

NO	IMPACT	IMPACT RATING	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT
			• The drilling rig will have a test separator to process any produced fluid from well testing operations. Any produced liquids will be stored in tanks and transported to existing facilities for processing. • Compliance with Municipality on waste matters. • Employing a waste management plan.	
14.	**Solid Waste** All Phases	**Minor 8**	• Work in concert with the Municipality to develop and implement a fit for purpose waste management plan. • Assess and create opportunities for Reducing, Reusing, and Recycling of waste generated. • Municipality making available suitable facilities for the collection, segregation, storage and safe disposal of the wastes. • Create waste collection areas for segregation of waste with clearly marked facilities such as colour coded bins. The bins to be coded according to biodegradable and non-biodegradable, reuse, recycling and reduce.	**Minor**
15.	**Noise** Construction	**Minor 7**	• Restrict construction activities to normal working hours 0800hrs to1700hrs • Inform local residents beforehand, via notices and advisories, of pending noisy periods and solicit their tolerance well before the commencement of demolition works. • Machinery should be maintained regularly to reduce noise resulting from friction during operations. • Drivers to adhere to speed limits within the project site access roads and vicinity • A grievance procedure will be established whereby noise complaints by neighbours are recorded and responded to. • Restrict hooting of vehicular horns. • Locate all stationary construction equipment (i.e., compressors and generators) as far as practicable from any nearby sensitive receptors. • Shielding the area to reduce noise propagation as necessary.	**Minor**

NO	IMPACT	IMPACT RATING	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT
16.	**Noise** Operations	**Minor 6**	• Machinery should be maintained regularly to reduce noise resulting from friction during operations. • A grievance procedure will be established whereby noise complaints by neighbours are recorded and responded to. • Muffle and maintain all construction equipment used. • Using modern machinery equipment with noise suppressing technologies in order to reduce the noise-rating as much as possible.	**Minor**
17.	**Noise** Decommissioning	**Minor 7**	• Restrict decommissioning activities to normal working hours 0800hrs to1700hrs • Inform local residents beforehand, via notices and advisories, of pending noisy periods and solicit their tolerance well before the commencement of demolition works. • Machinery should be maintained regularly to reduce noise resulting from friction during operations. • Drivers to adhere to speed limits within the project site access roads and vicinity • A grievance procedure will be established whereby noise complaints by neighbours are recorded and responded to. • Restrict hooting of vehicular horns. • Locate all stationary construction equipment (i.e., compressors and generators) as far as practicable from any nearby sensitive receptors. • Limit pick-up trucks and other small equipment to an idling time, observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible. • Shielding the area to reduce noise propagation as necessary.	**Negligible**
18.	**Light, Heat and Odours**	**Minor 5**	• The site occupies a small area will be in place temporarily. • Any important sensitivity in the project areas (e.g. infrastructures, areas of significant vegetation cover, sensitive cultivations, important sites for cultural heritage, etc.) will be identified and avoided as appropriate. • Use a lower level of lighting i.e. sufficient to enhance the night-time visibility required for safety and security	**Negligible**

NO	IMPACT	IMPACT RATING	PROPOSED MITIGATION MEASURES	RESIDUAL IMPACT
			• Use specifically designed lighting equipment that minimises the upward spread of light near to and above the horizontal. • Shading floodlights to only shine inside the site perimeter • Turn off all unnecessary lighting at night to avoid disturbing wildlife and migratory birds.	
19.	**Community** All Phases	**Minor 8**	• Consultation with the Municipality and liaison with community during the planning phase. • Establish a robust, open, two way Complaints/Grievance Mechanism. • Establishing emergency procedures and ensuring the community are aware and educated on following them and commensurate to the magnitude and type of risk. • The work site will be fenced off to protect the general public from dangers associated with the drilling operations, including security in and around the site to control the movement of people. • Placing visible and readable warning signs around the work site and access roads where there are exposures. • Compliance with Timor Resource's local content policy that reflects the requirement to hire locally, including a transparent and accessible application and short-listing process of workers. • Where possible, look into vocational training programs for the local workforce to promote development of skills required by the oil and gas industry.	**Minor**
20.	**Visual**	**Negligible 4**	• The site occupies a small area and the drilling facilities will be in place temporarily. • The project is limited spatially to the one-hectare drilling location and its immediate surrounds and is short term and transient in nature. • Any important sensitivity in the project areas (e.g. infrastructure, areas of significant vegetation cover, sensitive cultivations, important sites for cultural heritage, etc.) will be identified and avoided as appropriate.	**Negligible**

9.5 INCORPORATION OF MITIGATION MEASURES INTO THE DESIGN OF THE PROJECT

Timor Resources is committed to achieving incident free operations through the provision of effective HSE management across all of its operations and worksites for the benefit of employees, contractors and the community, this is achieved through application of the Company's Operating Management System (OMS). The eleven Elements of the OMS are summarised in Table 9-53 and is based on the international standard **PLAN-DO-CHECK-ACT**.

Once the full assessment is completed any mitigation measures identified for the management of impacts will be integrated into the project design through the OMS. Implementation will follow Timor Resources HSE Policy and the OMS and meet Timor-Leste legislation and regulations, in particular, Environmental Basic Law No 26/2012, Environmental Licensing Decree Law 5/2011 (and supporting Ministerial Diplomas 45/46/47) and Decree-Law No.18/2020 Onshore Petroleum Operations.

The key OMS elements for implementation of the mitigation measures are included under:

- Element 7 Operational Controls:
  - Health, Safety and Environmental Management
  - Management of Change
  - Contractor and Purchasing Management
  - Asset Integrity, Engineering and Project Management
- Element 9 Crisis and Emergency Management
- Element 10 Assurance
  - Inspection and Audit
  - Non-Conformance Corrective and Preventative Action
- Element 11 Performance and Compliance

Full details are provided in the Environmental Management Plan (EMP) and a summary of the key elements of the EMP are included in Section 12.

Table 9-53. Timor Resources Operating Management System

PDCA CYCLE	OMS ELEMENT	OBJECTIVE
CORE	1. LEADERSHIP AND ACCOUNTABILITY	Provide visible leadership at Corporate and Business Unit level with clearly defined and documented authority and accountability. Champion Corporate culture, behaviours and performance.
PLAN	2. RISK ASSESSMENT AND CONTROL	Conduct comprehensive and routine assessment of the hazards and risks associated with activities and operations. Appropriate action is taken to control and mitigate risks. Conduct routine reviews.
	3. POLICIES, EXPECTATIONS AND LEGAL REQUIREMENTS	Policies, Expectations, Standards and legal requirements are properly identified, interpreted and tracked.
	4. OBJECTIVES, TARGETS AND IMPROVEMENT PLANS	Set Objectives and establish annual Targets and Key Performance Indicators. Define effective ways of measuring progress and performance. Specify how performance improvements will be achieved and assign responsibilities.
	5. ORGANISATION, RESOURCES AND CAPABILITY	Define and document organisational structure. Specify resource, competence and assurance requirements. Implement training, organisational learning, and competency development programs.
	6. DOCUMENTS AND RECORDS	Establish and maintain appropriate and practical documentation and records, document control and record management systems.
DO IMPLEMENTATION AND OPERATIONS	7. OPERATIONAL CONTROLS	Appropriate systems and controls are implemented and maintained for all HSE, Security, Engineering, Project, Asset Integrity, Process Safety and Operational activities. Monitor and report on the effectiveness of the systems, and establish mechanisms to prevent non-compliance, corrective and preventative action. Implement methods to manage change and controls for contractors.
	8. COMMUNICATIONS	Establish and maintain processes and procedures for effective communication of information internally and engagement with partners and all other stakeholders.
	9. CRISIS AND EMERGENCY MANAGEMENT	Develop Crisis and Emergency Management capability. Implement and maintain for all activities and operations. Plans are tested and personnel are trained in their expected roles.
CHECK ASSURANCE	10. ASSURANCE	Implement a routine Assurance program: inspection and audit, and a system for managing non-conformance. Report, investigate and analyse all incidents, and act effectively on results.
ACT	11. PERFORMANCE AND COMPLIANCE	Establish and maintain appropriate systems for monitoring and reporting performance and the status of Governance: compliance with and performance of Policies, Expectations, Standards and legal requirements. Assess the effectiveness of the OMS to deliver sustainable performance through management review.

10 PRELIMINARY EVALUATION OF SOCIAL IMPACTS

The social background to the project is detailed in Section 6.4 and a preliminary assessment of impacts are described in Section 9.3, with specific reference to the positive social interactions addressed in 9.3.1 and Community impacts in 9.3.8. Further, significant social benefits arise in terms of the economic assessment described in Section 11.

10.1 PURPOSE AND OBJECTIVE

The main objective of this preliminary social impact evaluation is to identify any social aspects which can potentially be impacted by the proposed project, and to examine possible management and control measures to avoid, mitigate and/or compensate any adverse impacts, if and when they may arise.

The preliminary evaluation has been undertaken only for those communities that might potentially be affected by the project activities either directly or indirectly, especially those close to or nearby the drilling location.

The proposed drilling site will not require any resettlement of people. All areas of cultural significance have been avoided. Land use and land access will include:

- Negotiations in good faith and in a respectful and reasonable manner.
- Consultation with landowners to obtain their consent. These consultations typically cover the impact and term of the proposed use or access, employment and business development opportunities.
- A land use agreement.
- Compensation and land rental with local landowners for land use in accordance with the Timor-Leste rates, as required by the Onshore Decree Law of Timor-Leste. Compensation payments are transparent and made in the presence of relevant community and government representatives or independent observers.

Further, there is unlikely to be any restriction to access of communities to their homes agricultural sites, education and health facilities and/or other public services.

The method used for completing this preliminary evaluation is as follows:

- Field observation and discussions in the community areas.
- Interviews with relevant stakeholders, such as community elders, Chefe Suco, health workers, Post Administrator and the president of the Municipality.
- Conduct a series of project socialisation and public consultations with local communities, especially those that reside within the potentially impacted areas, where the drilling site is located or identified, the TR Stakeholder Engagement Guidelines and Community Consultation Plan will be included in the EMP (EMP Appendix I).

The components taken into consideration during the assessment include: socio-cultural aspects, legislative and regulatory consideration; social issues analysis; strategy for social development outcome; social implications analysis and alternatives; and recommendation and monitoring plans for the proposed project. The purpose is to identify the social aspects that might be impacted by the implementation of the proposed project – to design a methodology for social assessment that will avoid, mitigate and compensate any adverse impacts in order to improve general conditions. Furthermore, this assessment will also provide an overview of the possible

social development such as employment and training that will bring positive impact to the community.
The scope of this preliminary social assessment will include the area where the Rusa-1 Well is located in Suco Foho-Ai-Lico, Posto Hatu-Udo, Ainaro Municipality. The radius of the social assessment is around 10 km of the drilling point.

The socio-economic team will be conducting a series of socialisation and public consultation with the community in the surrounding area as part of the full social assessment. During such public consultations with local communities, the concerns, recommendation, perspective and insight will be recorded and analysed in order to develop social impact evaluation framework that will provide a mitigation and control measures to the community affected by the project.

10.2 Description of Socio-Cultural, Institutional, Historical and Political Context

Generally, qualitative description of socio-cultural aspects in Timor-Leste is profound both from cultural practices standpoint to societal norms. Timor-Leste's communities are unique and strong in many different social aspects – those include traditional animist beliefs, influence from former colony of Portugal, impact of WWII, and the more recent Indonesian invasion in 1975-2002. For many communities in all administrative division, there is a profound sense of cultural identity. The country is rich in cultural heritage going down from generation to generations which will be a great tourism potential. Closer assessment to qualitative description such as institutional, historical and political context assessed is discussed in the following sections.

Traditional institutional set up in most Timorese community is Uma-Lulik (sacred house). It is an ancestral house which considers as social representation of family and symbolic representation of certain culture. This can be said in Suco Foho-Ai-Lico. Many societal rules and norms have been practiced for a long time is passed down for generations. Different Uma-Lulik from different Sucos/Aldeia has its own sets of traditional practices. For example, some cultures prohibits people to eat a certain vegetables, some cultures prohibits people to eat certain Animal Meat. Community in rural area gives importance to Uma-Lulik norms as the basis of their rule of law within the community. Beside consider Uma-Lulik (sacred house) as sacred place, people also believe in powers resides in Rivers, Lakes, Stone, trees, Mountains and Animals. Animism beliefs are widely practice in most Timorese societies, the same can be said in Suco Foho-Ai-Lico. These cultural aspects and sacred things must be considered and followed during the design and implementation of the project.

Historically, the Portuguese presence in Timor-Leste has changed the cultural landscape in Timor-Leste but mostly in urban cities, like in municipality or administrative post, but not so much in remote villages. Traditional beliefs in Christianism change the beliefs of people in a way. Some people have a tendency to incline more into Christian beliefs than in animism beliefs. This instance is very noticeable in urban Population like in Municipality or administrative post, but not so much in remote areas like in Sucos and Aldeias. Remote society like the one in Suco Foho-Ai-Lico, majority of people still have a strong traditional belief.

In the political context of the government, Secretario Estado Arte no Kultura, is the government institution whose jobs to protect national identity by preserving its cultural heritage. Laws and regulations for the protection of Cultural heritage is being emphasized in Diploma Ministerial (*check laws regards to cultural protection*). During the design and implementation of the project, consideration of cultural heritage must be taking into consideration.

From the aspects of institutional consideration, communities value "Uma-Lulik" as a symbolic representation of their culture. People have strong values to sacred places as their traditional beliefs that cannot be violated. Historical standpoint, the socio-cultural landscape in Timor-Leste has also change a lot since the presence of Portuguese and Christianism. Political context of the government has clear policy to protect cultural heritage as national identity. A more detailed quantitative indicator such as general population demographic, livelihood, educations, employment and others are presented in section 6.4 of this EIS.

10.3 LEGISLATIVE AND REGULATORY CONSIDERATION

The highest legislation in Timor-Leste is the constitution of the Democratic Republic of Timor-Leste. According Constitution of RDTL (2002) government and its proponent has obligation to protect the environment, recognise the rights of all citizens to health and ecologically balanced environment; specify the role every key stakeholder for environmental preservation to guarantee future benefits for generations to come (Article 61). This law is relevant to the proposed project is to provide a legislative basis for environmental protecting and social safeguarding in the project area. The Constitution Article 141 states: *Ownership, use and development of land as one of the factors for economic production shall be regulated by law*.

Commonly the law for preserving and protecting the environment is known as Environmental Legislative or environmental protection law. This law is usually to provide policy guidelines for the protection of environment, socio-cultural, socio-economic, mitigation measures and compensation requirements for the design, implementation and decision-making process of proposed project. There are several environmental protection and social safeguard laws that are in effect namely, Environmental (licensing) Decree Law No. 5/2011, Decree Law No. 5/2016-National System of protected Areas, Decree Law No. 26/2012 on basic environmental law, Decree-Law No. 18/2020 Onshore Petroleum Operations and many other laws as well as several diploma Ministerial that regulate project proponent during the development of the proposed project.

The overall relevance of the above mention decree laws and diploma ministerial to project is summarizing as following. The Environmental Licensing Law, Decree Law No. 5/2011 provides a procedure for environmental licensing process, and to control action and ensure environmental safeguards practice and to promote sustainable development in Timor-Leste. Decree Law No. 5/2016-National System of protected Areas specifies the basis for the protection of terrestrial and marine areas which includes the roles of community authority and local customs. Moreover, Decree Law No. 26/2012 provide as basic environmental law which includes local community consultation by providing relevant information with regards to environmental protection measures to ensure sustainable use of natural resources. Furthermore, Decree-Law No. 18/2020 Onshore Petroleum Operations is to provide fundamental legal basis for all oil and gas operations onshore in Timor-Leste.

Thus, rigorous assessment for environmental protection, socio-cultural aspect, economic benefits of the proposed project must be monitored. Mitigation measures for potential environmental and social impact must be assessed to provide necessary action response plans. These plans will include avoidance, mitigation, relocation and/or compensation measure according to legislation and regulation in decree law and diploma ministerial in effect.

Socio-cultural aspects of the project will be developed in accordance with Timor-Leste national legislation and regulation (Decree Law), and relevant Diploma Ministerial.

Other relevant legislation and regulations include:

- Labour Law (Law No.4/2012)
- Environmental Licensing Law (DL No.5/2011)
- Onshore Petroleum Operations Law (Law No.18/2020)
- Impact Benefit Agreement (DM No.44/2017)
- IFC EHS Guidelines and where applicable Performance Standards
- TR Code of Business Conduct
- TR Health, Safety and Environmental (HSE) Policy
- TR Stakeholder Engagement Guidelines (TR-HSE-GUI-001)
- TR Redress and Grievance Plan (EMP Appendix C: TR-HSE-PLN-009)
- TR Community Consultation Plan (EMP Appendix I: TR-HSE-PLN-013)

Timor-Leste's Labour Law guarantees '*the equality principles*' under Chapter II, Article 6 which ensure equal opportunities for everyone accessing employment, training and professional development, working condition and remuneration. Furthermore, according to the law no applicant will be preferred or disadvantaged due to origin, race, colour, ethnic, social, economic and political status or ideological beliefs, religion, physical and mental condition or age.

IFC Guidelines and Performance Standards also encourage non-discrimination and equal opportunity principles for employment opportunities and fair treatment for all workers including protecting vulnerable workers such as children, migrant workers, and workers engaged by third parties and the contractors.

TR operates under a strict Code of Business Conduct that ensure productive relationships are established with the community, suppliers, customers and business partners, and conducting all activities with transparency and integrity. All public communications untruths and concealment are avoided, and all parties shall conduct their business dealings with a high priority for ethical standards, honestly, openly, fairly and safely and expect the same of all those with whom business is conducted. The Company will:

- Operate as a responsible member of the communities of which it is a part, exercising care and sensitivity towards the environment.
- Show respect for human dignity and internationally recognised human rights wherever it operates. Strive to ensure that those countries and communities where business is conducted benefit from its presence and aim to minimise any adverse effects its activities may have on the environment.
- Adopt appropriate HSE polices to govern its activities.
- Ensure that partners and contractor's policies are compliant with its standards and recognise that all working on the its' behalf can impact operations and reputation and that a common responsibility for safety is shared by all.
- Review and ensure opportunities are provided for access by poor and excluded groups to goods, services and opportunities provided by the project and the enabling environment for public participation.

TR Code of Business Conduct, Policies and the Operating Management System ensures equal opportunities and non-discriminatory principles in accordance with TL laws and IFC Guidelines. Hence, where applicable, the procedures allow everyone to access employment opportunities, provide goods and services and other related business activities during the

11 PRELIMINARY ECONOMIC ASSESSMENT

This preliminary assessment involves analysing a number of issues related to the economic viability of a project that carried out at different stages throughout the operational cycle. It is known that the most recent recorded economic activities inside the drilling area are significantly low. The data has shown that approximately 41 % population in affected area live with an income around $1.00 per day, because they rely on their traditional way of farming as the main source of income. In addition, the employment rate aiming for higher-income is still slow even on the municipal and national level. Therefore, the presence of the project is likely to have positive impacts either direct or indirect especially to the communities residing in the vicinity of the drilling area, where there may be some opportunities for employment associated with the project.

In the event that commercial quantities of hydrocarbon are discovered, more long term employment opportunities may be created. Once employment opportunities are identified, all hiring will be carried out according to the company's Code of Business Conduct and include a transparent hiring process to avoid any resentment among locals. The first consideration will be given to residents of the affected area as a whole when they have the adequate competencies.

Other opportunities besides job-related will be training ranging from language, safety in the workplace, and computer skills that will aid the workers to gain more experiences for future work.

Manufacturers, consultants, contractors and service companies will receive a full and fair opportunity to provide goods and services to the project on a competitive basis. This indirect involvement includes catering, internet service providers, vegetables, and other suppliers. The economic impact of direct and indirect income described in this section has the potential to significantly enhance the quality of life of the people in the affected area generally people that live in and around Suco Foho-Ai-Lico Post Administrative of Alas, Municipality of Manufahi.

The costs, benefits and cost effectiveness of mitigation measures for environmental impacts of the project will be alleviated through the following acceptable standard approaches:

- Establish and implement the best environmental monitoring program to control and monitor the project implementation which the impacts should be within acceptable standard threshold that has been planned.
- Select appropriate drilling equipment, decommissioning technology and approach that reduce the severity of the environmental destruction.
- Develop and implement biodiversity activities plan to replace or restore any loss forest ecosystem, terrestrial habitats, flora and fauna, wetlands and/or mangroves.
- Use proper equipment and methodology for site clearance to limit impacts of noise, dust and pollution to the nearest community and environment, and
- Establish good relationship with the local community.

In addition to that some other facility like road will be opened or reconstructed in order to access to the well location and facilitate mobilisation.

Timor Resources presence has the potential to have a positive and negative impacts, on the day-to-day lives of project area communities, so having the trust and support of local stakeholders is very important for the project to be successful.

The stability of the local operating environment depends on how our employees and contractors interact and engage with local communities, and on how we contribute to inclusive sustainable development.

11.1 Cost and Benefit of Environmental Impacts

11.1.1 Engagement and consultation

Developing strong, respectful relationships with community members and consulting with individuals or groups who are interested in or impacted – positively or negatively - by our activities protects our operational stability. Wherever possible, we seek to involve communities in decision-making and to gather the views of our stakeholders.

All our community engagement and consultation considers local land use rights and cultural heritage and practices. Our information dissemination, negotiation and engagement activities consider local decision-making customs and conventions.

We have established a local community liaison officer in Suai to facilitate ongoing communications and two-way-feedback.

Our Community Affairs specialists make regular visits to the villages, providing the opportunity for communities to raise concerns or grievances and discuss development projects or sponsorship opportunities. All the visits and resulting commitments are recorded centrally.

11.1.2 Grievance management

Providing effective channels for expressing and resolving grievances and concerns reduces the risk of escalation and ensures we address community concerns appropriately.

Community members can raise matters at the site through the local community liaison officers or during routine visits by our Community Affairs team. We record the grievance centrally, assess it for potential risk or impact, and elevate or respond to it accordingly. Material grievances are reported to the senior management team. This approach ensures grievances relating to our activities can be raised easily and in a culturally appropriate manner.

11.1.3 Land access and resettlement

The proposed drilling site will not require any resettlement of people and we have avoided all areas of cultural significance.

When engaging with project area community members regarding land access, we:

- Negotiate land access agreements in good faith and in a respectful and reasonable manner.
- Consult with landowners to obtain their consent. These consultations typically cover the impact and term of the proposed use or access, employment and business development opportunities.
- Put in place a community land use agreement, a resettlement and livelihood restoration plan, and agreements if displacement or relocation is required.
- We also pay compensation and land rental amounts to local landowners for land use in accordance with the Timor-Leste rates, as required by the Onshore Decree Law of Timor-Leste. We assess and pay this compensation transparently, in the presence of relevant community and government representatives or independent observers.

12 PROPOSED ENVIRONMENTAL MANAGEMENT PLAN

An Environmental Management Plan (EMP) for construction, operations and decommissioning phases will be prepared. This will include requirements for monitoring, auditing, and compliance. International Finance Corporation Performance Standard 1 (IFC 2012) underscores the importance of managing environmental and social issues throughout the life of a project. An effective EMP is a continuous process requiring engagement between the proponent, the local communities directly affected by the project and other stakeholders such as National and Municipal authorities.

The EMP will follow the Timor Resources OMS "*Plan - Do - Check - Act*" PDCA cycle appropriate to the nature and scale of the project and the impacts identified and summarised in this EIA by:

- Adopting a mitigation hierarchy to anticipate, avoid, minimise and, where residual impacts remain, offset impacts to the environment and affected communities.
- Ensuring that all grievances from the community are responded to and managed appropriately.
- Promoting and providing adequate engagement with communities throughout the project on issues that could potentially affect them and ensuring that relevant information is disclosed and shared.

The EMP will outline the actions and outcomes required to address the issues raised in the EIA, and include performance standards, targets and time frames, and assigning responsibilities for implementation.

A grievance mechanism will be established to resolve concerns promptly, following an understandable and transparent consultative process that is readily accessible, at no cost and without retribution to the party that originated the issue or concern.

12.1 POSSIBLE MITIGATION MEASURES

Based on the preliminary assessment of impacts and possible mitigation measures described in Section 9.4 and summarised in Table 9-51 positive impacts and Table 9-52 negative impacts.

12.2 MONITORING MEASURES

The EMP will describe the key aspects of the monitoring program through performance standards, targets, time frames and responsibilities.

13 DISCLOSURE OF INFORMATION AND PUBLIC CONSULTATION DURING THE EIA PROCESS

13.1 PURPOSE OF THE CONSULTATION DURING THE PREPARATION OF EIS

Public Consultation is a key requirement in obtaining the environmental licence under Law 5/2011, with the process determined under Ministerial Decree 47/2017. The Consultation provides an opportunity for Timor Resources to disseminate technical and non-technical information on the project to local communities, as well as an opportunity for the public to provide input, opinions and ideas regarding the project. Timor Resources independent consultant Groena Circoal will present information on the location of the drilling site, the well depth, equipment to be used, infrastructure involved, as well as the legal basis, local content, and the potential effect on communities and the surrounding environment.

In addition, the consultations will be used to identify community or individual land and housing which might be directly or indirectly affected by the activities.

13.2 METHODOLOGY AND APPROACH

Consultation is carried out through individual approach, small group discussion and public consultation. Affected individuals or families are directly approached in the case of land use or farmland used as a drilling site. Small group gatherings will also be carried out with local elderly to discuss the cultural ceremony requirements and, with local authorities, to disseminate information and discussion on public consultation.

The Public Consultations will comprise direct meetings between Timor Resources as the project proponent and the general public, local institutions and other interest parties. The facilitator and the project proponent will directly present the material to the participants with a specific session dedicated to question and answer.

Before starting the consultation, the facilitator will engage directly with the participants to provide information on the structure of the public consultation itself.

The Public Consultations will be carried out at separate gatherings for each village or sucos closest to the drill site the participants will be invited to attend one day presentation. Public notices will be sent out to invite any interested parties or individuals to attend as well as being published at the Municipality, sucos offices and in the local community at meeting halls and schools as well as advertised on television and radio.

14 PRELIMINARY REVIEW FINDINGS

Following an initial review of the description and nature of the proposed works (Section 4) and consideration of the prevailing environment (Section 6), the preliminary findings identify potential residual impacts after mitigation (Section 9) that are summarised in Table 14-1 :

Table 14-1. Summary of Residual Impacts

NO	IMPACT	INITIAL IMPACT RATING	RESIDUAL IMPACT AFTER MITIGATION
1.	**Land Use All Phases**	**Minor 5**	**Minor**
2.	**Traffic All Phases**	**Moderate 9**	**Minor**
3.	**Soil All Phases**	**Minor 7**	**Minor**
4.	**Air Quality Construction**	**Moderate 9**	**Minor**
5.	**Air Quality Operations**	**Minor 7**	**Minor**
6.	**Air Quality Decommissioning**	**Moderate 9**	**Minor**
7.	**Surface Water All Phases**	**Minor 4**	**Negligible**
8.	**Groundwater All Phases**	**Minor 5**	**Negligible**
9.	**Operational Leaks and Spills All Phases**	**Minor 4**	**Negligible**
10.	**Worst Case Oil Spill Operations**	**Moderate 8**	**Moderate**
11.	**Water Supply All Phases**	**Negligible 2**	**Negligible**
12.	**Biodiversity, Flora and Fauna All Phases**	**Minor 5**	**Negligible**
13.	**Liquid Effluents All Phases**	**Minor 7**	**Minor**
14.	**Solid Waste All Phases**	**Minor 8**	**Minor**
15.	**Noise Construction**	**Minor 7**	**Minor**
16.	**Noise Operations**	**Minor 6**	**Minor**
17.	**Noise Decommissioning**	**Minor 7**	**Negligible**
18.	**Light, Odours and Heat**	**Minor 5**	**Negligible**
19.	**Community**	**Minor 8**	**Minor**
20.	**Visual**	**Negligible 4**	**Negligible**

In completing the preliminary assessment, a standard impact assessment technique was applied that indicated most potential impacts can be classed as having a "Moderate" significance level which can be reduced to "Minor" on the application of mitigation measures. Those identified as "Minor" may subsequently be reduced to "Negligible" on application of residual measures. The singular exception relates to a catastrophic oil spill which could potentially result in a "Major" impact, that is, potentially long term and affecting a larger regional area beyond the site, this mitigated by the implementation of an oil spill contingency plan and the emergency response and incident management plans, reducing the impact to "Moderate". The preliminary assessment fully reflects that the project is limited spatially to the drilling location and immediate surrounds and is short term and transient in nature, thus, there is limited potential to cause any permanent or significant impacts. The potential negative residual impacts are considered inconsequential compared to the benefits generated

The preliminary review identified the following possible residual impacts are:

- **Traffic** - An increase in traffic may create a nuisance and potential impact on the safety of other road users. Limited number of locations and roads, short program and transient nature of the project limits potential effects.
- **Soil** - Removal of topsoil and soil compaction will occur during the construction phase, any effects will continue through operations until the site is decommissioned and rehabilitated.
- **Air Quality Construction** - A decrease in Air Quality from dust may cause nuisance and impact on the fauna and flora around the project site. Short construction program, low levels of diesel usage limit potential impacts.
- **Air Quality Operations** - A change in Air Quality from gaseous emissions may create a nuisance and minor impact on the fauna and flora around the project site. A short drilling program (30 days) impacts limited given the low levels of diesel usage, in the region 5000L/day or 150 tonnes diesel per day.
- **Air Quality Decommissioning** - as in the construction phase dust may cause a nuisance and impact on the fauna and flora around the project site, but this again will be temporary. The decommissioning period is short, impacts are considered short term and transient.
- **Solid Waste** - by the nature of the project, solid wastes will arise, waste management will provide the best available solution for waste management, however, the principal method of incineration will result in emissions to the atmosphere. Also, by nature of the project such emissions will be short term. A Waste Management Plan (WMP) will be developed and will take into account the existing elimination processes for treating or eliminating, partly or fully, all waste generated by the project.
- **Noise Operations** - drilling operations will be conducted on a 24 hour, 7 day per week basis so may cause a nuisance for local communities and wild life, but the duration is less than 30 days, thus is short term and transient.

Mitigation measures will be proposed for all the negative impacts identified during the EIA process to protect the physical, biological, and socio-economic environments. An Environmental Management Plan (EMP) will be developed in concert with the EIS, to manage any potential impacts and ensure that they remain at acceptable throughout the course of the program.

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