PNG RESILIENT TRANSPORT PROJECT

Preliminary Environment and Social Impact Assessment

Prepared for the Department of Works and Highways, Papua New Guinea

11 February 2022

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Project name: PNG Resilient Transport Project

Date: 11 February 2022

Declaration of accuracy:

The undersigned declare that the information provided herein is true and accurate and provides a complete description and assessment of the activity.

Prepared by	**Approved by**
Edward Nock Senior Environmental Scientist 11 February 2022	**REFER COVER LETTER**

Version no	**Date**	**Change summary**
1	8/11/2021	1st Draft
2	21/12/2021	2nd Draft
3	22/01/2022	3rd Draft
4	11/02/2022	Final

Executive Summary

The PNG Resilient Transport Project

The objective of the PNG Resilient Transport Project (RTP) is to enhance resilience and safety of priority road infrastructure and strengthen institutional capacity in the road sector. The main beneficiaries of the project will be the local communities and businesses along the selected road alignments, transport sector providers and local contractors. The focus of the RTP is to enhance climate resilience of priority road infrastructure and strengthen the road transport institutional framework while maximising their positive impacts on other economic sectors.

The RTP involves work for the Ramu and Hiritano Highways which are identified as 'Priority Core Roads" in the PNG National Road Network Strategy 2018 – 2037. The Ramu Highway forms the primary connection between Madang and Lae city ports, and connects those cities to the Madang, Morobe and Eastern Highland provinces. The Hiritano Highway is a major economic corridor between Gulf Province and Port Moresby.

The Project has three components:

Component 1 relates to physical Improvement and Sustainable Maintenance of Ramu and Hiritano Highways:

- Ramu Highway: A single contract for the design and reconstruction of 40-45 kilometres of the road, with a performance-based maintenance of the full length - approximately 175 kilometres - from Pompaquato bridge in Morobe province to Madang airport junction in Madang province.
- Hiritano Highway. The RTP will continue the work of RMRP II on the Hiritano Highway by rehabilitating the heavily trafficked 22.5 kilometres section between Laloki River (on the boundary of the National Capital District (NCD)) and Brown River through a design, build and maintenance contract. It is anticipated that Additional Financing opportunities will enable renewal of performance -based maintenance of Brown River / Bereina once the current RMRP2 contract expires, thereby bringing a total length of 150 kilometres, or approximately half the 300 kilometres long highway, under a performance-based maintenance regime.
- Road safety strengthening involving awareness of road safety issues and better implementation of regulations aiming at reducing accidents.
- Search for higher impacts on the corridor by further empowering women

Component 2: involves Institutional Strengthening, Project Management and Technical Assistance for the Department of Works and Highways (DOWH) including

- Financing the operating costs for a Project Implementation Unit within DOWH;
- Financing a range of institutional strengthening initiatives and technical assistance to provide sustained management; and
- Providing technical assistance to provide sustained management and technical skills development to DOWH and its Provincial Works.

There is also a third component which is a Contingency Emergency Response Component (CERC) which supports post-disaster recovery - through a zero-budget disaster recovery contingency fund.

Preliminary Environment and Social Impact Assessment

Under the World Bank's Environmental and Social Framework (ESF), an ESIA is required for RTP works. This Preliminary ESIA assesses the potential risks and impacts associated with Project activities and outlines appropriate mitigation measures.

This Preliminary ESIA identifies and considers required PNG legislative requirements, guidelines and codes of practice and World Bank Environmental and Social Standards. An environmental and social baseline and context has been prepared drawing on existing E&S studies including: Ramu Gateway Joint Venture studies conducted in 2015 and ADB Ramu Bridge Replacement studies (Ramu and Hiritano) conducted in 2011 and updated in 2015; and the RMRPII studies (Hiritano) conducted in 2015 and 2019.

To the extent possible, without the completion of detailed designs, this document identifies project activities, sites, surrounding areas, environments and people affected by the RTP, assesses the risks and impacts, identifies the measures to eliminate or offset adverse environmental and social impacts, or to reduce them to acceptable levels and the actions needed to implement these measures.

This Preliminary ESIA also identifies any further investigations required for specific impacts and management measures to be undertaken when preparing a Final Project-wide ESIA during implementation. The Final ESIA will also define an area of influence for the Project. At the time of writing no alternatives have been identified but alternatives will be considered during detailed design of the RTP structures.

Environmental and social management (including ESIA findings) will be incorporated into the tendering process through two types of tendering, i.e. procurement of (a) Supervision Engineer and (b) Contractor for civil works.

Key Potential Environmental and Social Impacts

Overall, the RTP will be environmentally and socially beneficial by providing improved road infrastructure that is better able to cope with weather events and provides greater levels of service to affected populations. Regional transport infrastructure is essential to support the wellbeing of rural communities by facilitating education and health service delivery, providing opportunities for local economic development through improved access to markets, opportunities for increased agricultural production, onsite processing and increased local employment. Other benefits include improved pedestrian and road safety, greater resilience and effective emergency response, improved amenity and improved erosion and sedimentation control.

The project is unlikely to cause major longer term negative environmental or social impacts as the work is generally not expanding the existing road footprint and sealing sections of the road will significantly reduce existing air quality, noise and safety issues. However, the roadworks through the Ramu Range create specific challenges and risks due to slope stability and by expanding outside the existing road footprint.

The environmental and social impacts have been assessed for the three phases of the project: design; construction; and operations and maintenance. Key impacts and mitigation measures for each phase are described below with further detail of all risks identified described in Sections 6 and 7 of the Report.

Design Phase

Key Environmental Risks

There is a risk of inadequate consideration of environmental impacts in design works results in unnecessary impacts (e.g., flora and fauna; surface water and freshwater ecosystems; slope stability; and damage to nickel slurry pipeline).

This will be addressed with the following mitigations:

- Suitably qualified design team;
- Alignment of footprint should favour areas that have already been disturbed;
- The draft design is to be reviewed and endorsed by E&S specialists before being finalised;
- Design is to incorporate permanent structures to reduce operational impacts on soil, water and biological resources;
- Completion of studies to inform design (e.g. Geotech. assessment); and

- Design works to consider nickel slurry pipeline (Ramu).

There will also be environmental, health and safety risks during field investigations and surveys (working adjacent to public roads, dust, noise etc.). This will be addressed by consultants(s) providing standard operating procedures for managing Environmental, Social, Health and Safety (ESHS) risks during conduct of field investigations and surveys.

Key social risks

Road safety is a key social risk for consideration during the design phase. The nature of this risk will vary from the steep terrain in the Ramu Range, with slower speeds, drop-offs and slope stability considerations, to greater potential for speeding on the flatter Ramu Valley and Hiritano Highway. This risk will be addressed through a Road Safety Audit by a qualified specialist to describe existing road conditions and provide recommendations for incorporation into design.

Highway market site planning, particularly for the Kawavur Market (central Ramu Range), plus other markets, is an excellent opportunity for positive Project impacts. This will be enhanced through site planning using stakeholder engagement, e.g.: to determine market site location and size, parking, lighting and safety for women.

A third key risk relates to land access and displacement. The project will not involve significant economic and physical displacement. It is understood that both corridors were acquired by the Government in the 1990s and 2000s but this will be further assessed. However, temporary use of land will be required for camp and storage areas. Minor land acquisition maybe required during reconstruction of the Ramu range section, including potential widening for passing lanes. Roadworks may also impact small structures, economic crops and trees in the corridor. It is also possible that some residential structures may be impacted and will require to be moved back/re-established outside the corridor. Mitigations for this risk will be applied according to the Resettlement Framework with resettlement plans prepared as required. Meaningful consultations and awareness will be conducted where the corridor is to be expanded. There will also be an inventory of assets completed within the areas affected by roadworks.

Construction Phase

Key Environmental Risks

Environmental risks from road construction, including impacts from ancillary infrastructure such as quarries, laydown areas and worker camps etc., relate to the following items:

- Vegetation clearance and impacts on biodiversity;
- Dust and noise emissions;
- Erosion and sedimentation (including major slope failure and impacts on water quality);
- Hydrocarbon spills or damage to nickel slurry pipeline;
- Solid and liquid waste management;
- Worker health and safety; and
- Poor decommissioning leaving waste, plant, unrehabilitated or contaminated land etc.

These will be addressed through standard mitigation measures outlined in the ESIA and through the contractor developing and implementing a Contractor Environmental and Social Management Plan (CESMP) with appropriate sub-plans.

Key social risks

The key social risks for the Construction phase relate to potential disputes about community labour, public health and safety, property damage and access and disruption to livelihoods.

A key social impact during construction is public health and safety due to the presence of an external workforce.

A Gender Based Violence - Sexual Exploitation and Abuse and Sexual Harassment Action Plan has been developed (refer Annex B). This plan includes measures such as a code of conduct, workforce training, community awareness and a GBV response protocol.

The contractor will be required to develop and implement a Workers Health and Safety Plan which will include a COVID Safety Protocol, Workers Code of Conduct, incident reporting, other safety measures and a program of awareness activities for employees and communities. Gender-based Violence, Gender and Social awareness and HIV/AIDS prevention sub-plans will be prepared and implemented. There will be traffic safety mitigations implemented around construction works along with environmental management practices for improved amenity.

Another social risk during construction is community Labour Disputes due to perceived inequitable provision/hire of labour. This is a common source of disputes in PNG. To minimis this risk the Project will seek to implement an equitable recruitment process with clear procedures, supported by community engagement. The Grievance Redress Mechanism will also be used and there will be a program of enhanced employment of women.

During construction there is a risk of property damage and access and disruption to livelihoods. This includes potential damage to crops and structures, reduced property access for businesses and limitations on community movements with the Ramu Range having steeper slopes and greater roadside concentration of people and assets. This will be addressed through:

- Preparation and implementation of Resettlement Framework and plans;
- Giving affected property owners/users adequate notice of roadworks; and
- Installing temporary access to affected properties where required.

Operations & Maintenance Phase

Key Environmental Risks

There will be a risk of ongoing erosion and sedimentation. Culverts and roadside drainage can experience a build-up of sedimentation through erosion events. This will be addressed through including a procedure for monitoring and managing erosion and sedimentation along the highway road easement and downstream drainage and containment structures.

There are also potential environmental and safety impacts from closed quarry sites (e.g. erosion and sedimentation, slope failure etc.). Appropriate treatments will be applied to quarries to address erosion, sedimentation and slope stability as part of their closure or handover to Government or another company. Contractors will develop and implement a quarry management plan including decommissioning requirements and CEPA will inspect quarries prior to formal closure.

Another risk is that of slope failure on highway section passing through the Ramu ranges. This will be address through controls outlined above for the Design Phase.

Key social risks

The key social risk in the operations and maintenance phase is community health and safety. Community feedback will be gathered during the operations and maintenance phase on road safety issues. Community road safety awareness activities will also be conducted focusing on sensitive receptors. There will also be maintenance of appropriate road signage and treatments, such a speed humps and pedestrian crossings at sensitive receptors such as markets, villages and schools.

Implementation Considerations

Stakeholder Engagement and Grievance Management

A grievance redress mechanism (GRM) will be established for the Project and is outlined in the Stakeholder Engagement Plan (SEP) and summarised in this Preliminary ESIA.

DOWH will be responsible for implementing the SEP working with the Employer's Project Manager and Works Contractor. Civil Works Contractors will be responsible for undertaking stakeholder engagement related to site preparation and construction of the specific physical works. Key requirements for Stakeholder Engagement are outlined in this ESIA.

Capacity Building

A capacity building plan for DOWH environmental and social resources will be developed and implemented throughout project implementation period. Capacity for project delivery will be enhanced through the appointment of an Employer's Project Manager.

Implementation Arrangements

Roles and responsibilities in environmental and social management are outlined in this Preliminary ESIA including procedural interactions between stakeholders during ESMP implementation.

The Preliminary ESIA includes principles for Project incident management and requirements for a detailed Emergency Response Plan.

Environmental and social monitoring requirements are also outlined which will include:

- Contractual requirements for specific monitoring and reporting;
- Specific monitoring and reporting requirement will be detailed in the CESMP before the commencement of civil work;
- Consultation for core communities and affected persons; and
- Routine site inspections and record inspections.

Terms and Abbreviations

AC	Asphalt concrete
Acidification	Acidification is a process that is characterized by increasing concentrations of hydrogen ions (H^+) in soil or water. It can cause metals and their compounds to ionize, producing ions (such as $Al^{3+)}$ in concentrations high enough to be toxic to plants, animals, and microorganisms. Consequently, increasing acidification is usually interpreted as a degradation of environmental quality. Acidification is caused by many influences, both natural and anthropogenic, but the most widespread problems are associated with a phenomenon commonly referred to as acid rain.
ADB	Asian Development Bank
Aggregate	A material or structure formed from a mass of fragments or particles loosely compacted together
Agro-industrial	Includes beef, sugar, and palm oil production
ALARP	As low as reasonably achievable
Alignment	Alignment is the centre line position of highway on the ground; it is also termed as highway alignment. The alignment guides the good pass of the road through wright Alignment, which is the most economical and easy to construct. There are mainly two types of alignment: • Horizontal Alignment: It includes a straight line, curve etc. • Vertical Alignment: It includes vertical or horizontal alignment.
Amenity	The pleasantness or attractiveness of a place.
Ancillary infrastructure	Relates to infrastructure that may be required for road works but are not part of the operating road such as quarries, laydown areas and worker camps etc. Ancillary infrastructure may be decommissioned following completion of road works.
Ancillary operations	Ancillary operations refer to the activities associated with the provision of resources for the road works such as concrete, asphalt and aggregate and the worker's camp/s.
Ancillary works	Construction work required to establish ancillary operations.
AoI	Area of Influence indicates where and to what extent a project/operation may have direct and indirect impacts. The AoI takes into account the physical, biological, ecological, socioeconomic, health and labour conditions that could be impacted by a project/operation.
Asphalt concrete	Composite material commonly used in construction of roads, highways, airports, parking lots, and many other types of pavement.

Asphalt concrete plant	A plant used for the manufacture of asphalt, macadam and other forms of coated roadstone, sometimes collectively known as blacktop or asphalt concrete.
Batching plant	A concrete plant also known as a batch plant or batching plant or a concrete batching plant, is equipment that combines various ingredients to form concrete include water, air, admixtures, sand, aggregate (rocks, gravel, etc.), fly ash, silica fume, slag, and cement.
BDS	Bid Data Sheet
Biological and ecological values	Includes threatened species, populations and ecological communities, parks, migratory habitat, foraging habitat.
Bitumen	Bitumen (also known as asphalt) is a sticky, black, highly viscous liquid or semi-solid form of petroleum. The primary use (70 percent) of bitumen is in road construction, where it is used as the glue or binder mixed with aggregate particles to create asphalt concrete.
Bitumen distributor	A tank truck with a perforated spray bar used for pumping hot bituminous material onto the surface of a road.
Borrow pit	An area created to remove earthen material from, which will be used for fill at another location.
Capacity building	Capacity-building is defined as the process of developing and strengthening the skills, instincts, abilities, processes and resources that organizations and communities need to survive, adapt, and thrive in a fast-changing world. An essential ingredient in capacity-building is transformation that is generated and sustained over time from within; transformation of this kind goes beyond performing tasks to changing mindsets and attitudes.
CEPA	Conservation and Environment Protection Authority
CERC	Contingency Emergency Response Component Financing emergency response to an eligible crisis or emergency should the Government of PNG so request the support of the World Bank to reallocate resources towards that effort
CESMP	Contractor Environmental and Social Management Plan
Chipseal	A pavement surface treatment that combines one or more layer(s) of asphalt with one or more layer(s) of fine aggregate.
Chip spreader	Chipping spreader is a self-propelled machine that lays coated chippings on roads for maintenance treatment.
Clearing and grubbing	Clearing of vegetation, all minor built structures (such as fences and livestock yards), all rubbish and other materials which are unsuitable for use and the grubbing of trees and stumps. Mulching of native trees, stockpiling the mulch, and the removal from site and disposal of all materials from built structures, rubbish, weeds and exotic plants. In advance of, or in conjunction with, clearing and grubbing operations, effective erosion and sediment control measures must be implemented as required in the Specification.

Climate change	Long-term shifts in temperatures and weather patterns. These shifts may be natural, but since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels (like coal, oil and gas), which produces heat-trapping gases.
Climate resilience	The adaptive capacity for a socio-ecological system to: absorb stresses and maintain function in the face of external stresses imposed upon it by climate change and adapt, reorganize, and evolve into more desirable configurations that improve the sustainability of the system, leaving it better prepared for future climate change impacts.
Climbing lane	A roadway lane design allowing slower travel for large vehicles, such as large trucks or semi-trailer trucks ascending a steep gradient. As a result larger, slower mobile equipment can travel in the climbing lane without slowing traffic.
Closed quarry	Quarries that are no longer financially viable for material extraction.
Closure	When an operation/project no longer continues to function. The objectives of closure should involve making the operation/project safe, stable and non-polluting and wherever possible, these systems should be passive (i.e. not requiring intervention to maintain these objectives).
CO_2	Carbon dioxide
Community health and safety	Project activities, equipment, and infrastructure can increase community exposure to risks and impacts. Potential negative impacts affecting health and safety may arise from a broad range of supported activities, including from infrastructure development and construction activities, changes in the nature and volume of traffic and transportation, water and sanitation issues, use and management of hazardous materials and chemicals, impacts on natural resources and ecosystems, the influx of project labour, and potential abuses by security personnel.
Concept design	Conceptual design informs where additional studies will be required to quantify and qualify impacts of the design. During Conceptual design potential impacts of all options are screened.
Connectivity	Connectivity refers to the density of connections in path or road networks, and the directness of links. Connectivity stimulates development and economic activity, as well as engaging with communities whilst being sensitive to the environment. Well-connected corridors encourage seamless movement to both city, urban and suburban locations through providing customers with an alternate method of travel.
Coronus	Coral derived aggregates. Coronus aggregates vary from being hard and equiaxed with a small proportion of plastic fines to being soft and flaky with a high level of clayey material
Construction footprint	Area cleared to allow for construction activities to take place.
Containment structure	Engineered structures that contain water and withhold it. The purpose of a drainage containment structure can be to allow water to stand encouraging sedimentation, to prevent downstream erosion and to protect downstream areas from flooding.
Contaminated land	Contaminated land contains substances in or under the land that are actually or potentially hazardous to health or the environment.

Contracting agency	Organisation that established a contract. Contracting agencies represent the owner by helping select the design and construction teams and managing the design (preventing scope creep), helping the owner stay within a predetermined budget with value engineering, cost-benefit analysis and best-value comparisons.
Core drilling	Involves collecting rock and soil samples at representative levels below the desired foundation depths, at a collection of different locations in the building site. Drilling and core samples are used to create a soil profile for the site.
Cross drainage structures	Whenever highway crosses a river or stream, cross drainage works have to be provided. Sometimes water from side drains also is diverted away from the road through cross drains to divert water from the road to a water course. On highways usually culverts and bridges are used as cross water way of about 6 m, and then the cross-drainage structure is known as culvert. For higher discharge and greater linear way the structure is known as bridge.
COVID	A disease caused by the coronavirus, SARS-CoV-2. Coronaviruses are a large family of viruses that cause respiratory infections.
Crushing plant	One-stop crushing installation, which can be used for rock crushing, garbage crushing, building materials crushing and other similar operations. Crushing plants may be either fixed or mobile.
Culvert	Conduit used for the passage of surface water underneath a road formation or other embankment. Culverts comprise one or more pipes or box culverts, normally fitted with headwalls.
DCP	Dynamic cone penetrometer is used to determine underlying soil strength by measuring the penetration of the device into the soil after each hammer blow.
Decommissioning	Removal of plant, temporary infrastructure and waste; remediation of any hydrocarbon contamination; and the stabilisation and rehabilitation of disturbed land.
Design	Project design is an early phase of the project where a project's key features, structure, criteria for success, and major deliverables are all planned out. The aim is to develop one or more designs that can be used to achieve the desired project goals. In the context of RTP, the Design stages involve "conceptual design", "preliminary design" and "detailed design".
Design phase	The time in the project lifecycle when design work is undertaken.
Detailed design	Detailed design occurs after "Detailed Design Phase" project and involves detailed investigations into preferred alternatives to further qualify and quantify potential environmental impacts.
DFAT	Department of Foreign Affairs and Trade
Discharge	The volume rate of water flow, including any suspended solids (e.g. sediment), dissolved chemicals and/or biologic material which is transported through a given cross-sectional area.

Displacement	Both physical and economic impacts occurring as a result of development-induced land acquisition or restrictions on access to land or other natural resources that is imposed by a partner government on individuals, families or communities.
Diversion drain	A diversion drain is a channel constructed on the high side of a site to divert surface runoff from rainwater that would otherwise flow down onto the disturbed or active work area.
DOWH	Department of Works and Highways
Downstream drainage	Road runoff water that is directed off the road and into drainage structures down-hill of the road until it reaches an impoundment or an arterial drain/creek/river.
Drainage	The primary purpose of a road drainage system is to remove the water from the road and its surroundings.
Dredging	Dredging is the excavation of material from a water environment.
DRP	Decommissioning and Rehabilitation Plan
Drunk driving	Operating a vehicle under the influence of alcohol.
Earthworks	Earthwork consists of roadway excavations (cuts) and roadway embankment (fills) for highways and associated items of work. Earthwork includes all types of materials excavated and placed in embankment, including soil, granular material, rock, shale, and random material.
Emergency response	Any systematic response to an unexpected or dangerous occurrence. The goal of an emergency response procedure is to mitigate the impact of the event on people and the environment.
Emission	Emissions is the term used to describe the gases and particles which are put into the air or emitted by various sources
Employer's Project Manager	The borrower's [in this case DOWH] representative tasked with managing the project.
Works Contractor	Main contractor responsible for overseeing and managing the RTP. The work is delivered under a contractual agreement.
Environmental and social instruments	Instruments linking environmental and social policy development and decision-making to policy implementation. Starting from policy development, the policy problem is translated into operational goals, the appropriate instruments are chosen, and their implementation achieves the goals.
Environmental specialist	Person commissioned to ensure that environmental management of the project meets the conditions and commitments that the project prescribes to.
EPM	Employer's Project Manager

Equitable recruitment	Recruitment practices that are targeted at removing bias (both conscious and unconscious). Practices can include: • Attracting a wide pool of applicants; • Enabling participation from a diverse pool of applicants; • Overcoming unconscious bias in candidate review; • Creating an equitable interview process; • Establishing practices and environments that allow for the most effective onboarding of new candidates and ensure that they are designed to best suit the candidate and their cultural and gender practices.
Erosion and sedimentation	Erosion is the transport by wind, water and ice of soil, sediment and rock fragments produced by the weathering of geological features. Sedimentation occurs when eroded material that is being transported by water, settles out of the water column onto the surface, as the water flow slows.
ESF	Environmental and Social Framework
ESHS	Environmental, social, health and safety
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESSSB	Environmental, Social and Safety Safeguards Branch
Eutrophication	Eutrophication is the process by which an entire body of water, or parts of it, becomes progressively enriched with minerals and nutrients. This can result in harmful algal blooms, dead zones, and fish kills.
Feeder road	Secondary road used to bring traffic to a major road.
Field investigations	Inspections, surveys, audits carried out at locations where the RTP would be implemented. These are normally targeted on issues identified following screening processes where impacts extending beyond the existing highway road easements are likely. This work normally occurs during "Detailed Design phase".
Floodway	Areas of a floodplain where a significant discharge of water occurs during floods. Floodways are often aligned with naturally defined channels. They are the areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood level.
Full lifecycle	A construction project entails five important stages: initiation, planning, implementation, monitoring and performance, and closing. This is the full lifecycle.
Gabion baskets	Rectangular baskets made with galvanized wire. When using gabions as an erosion tool, the baskets are filled with stones.
GBV	Gender based violence

Gender-based violence	Harmful acts directed at an individual or a group of individuals based on their gender. It is rooted in gender inequality, the abuse of power and harmful norms.
Geotech	Engineering discipline that deals with soil and rock behaviour in an engineering perspective. It also involves assessing slope stability and the risk of landslides, rock fall and avalanches.
GoPNG	Government of Papua New Guinea
Grievance redress mechanism	Organizational systems and resources established by national government agencies (or, as appropriate, by regional or municipal agencies) to receive and address concerns about the impact of their policies, programs and operations on external stakeholders. The stakeholder input handled through these systems and procedures may be called “grievances,” “complaints,” “feedback,” or another functionally equivalent term.
GRM	Grievance Redress Mechanism
Groundwater	Water present beneath Earth's surface in rock and soil pore spaces and in the fractures of rock formations.
Haulage/haul road	Roads designed for heavy or bulk transfer of materials by truck.
Heavy metals	Heavy metals are naturally occurring elements that have a high atomic weight and a density at least 5 times greater than that of water. With the assumption that heaviness and toxicity are inter-related, heavy metals also include metalloids, such as arsenic, that are able to induce toxicity at low level of exposure.
Highway corridor	See “Road Easement”
HIV/AIDS	Human immunodeficiency virus/Acquired immunodeficiency syndrome
HSEMP	Health, safety, environmental and social construction management plan
Hydrocarbon	An organic chemical compound composed exclusively of hydrogen and carbon atoms. It is well known that emissions and pollution created by human beings are dangerous, and hydrocarbons make up a large portion of these damaging compounds. Hydrocarbons are the main component of crude oil, natural gases, and most pesticides.
Implementing agency	Organisation responsible for executing an action (e.g. policy, Legislation, projects etc.).
Infall drainage	Surface water is directed towards a cut batter or hillside to be captured by a table drain.
Institutional strengthening	Organizations that wish to develop or improve existing institutional strengthening systems and processes. It presents principles, minimum standards, best practices, business processes, references and tools for effective, efficient and sustainable organizations.
Inter-modal connectivity	Intermodal transportation implies that two or more modes of transport are used to move a unit of freight between its origin and destination. Connectivity relates to the way that each mode of transport is connected allowing goods to be transferred from one mode of transport to another.

Invert	The invert level is the bottom of the inside of the pipe, box culvert, culvert inlet or outlet structure, catchpit, manhole, open drain etc (i.e. any structure that conveys water), so in other words, bottom water level. (The 'overt' is the top of the pipe)
Joint Venture	An agreement between two or more parties to work together for the purpose of completing a specific task or project.
Labour disputes	A disagreement between an employer and employees regarding the terms of employment.
LMP	Labour Management Procedures
Land access	The permission or freedom to use, enter, approach or pass to and from a tract of land, which often consists of real estate property.
Landlocked	Land that cannot be accessed.
Laydown area	An area that has been cleared for the temporary storage of equipment and supplies. Laydown areas are usually covered with rock and/or gravel to ensure accessibility and safe manoeuvrability for transport and off-loading of vehicles
Liquid waste	Any waste material that passes the definition of a “liquid.”
M&E	Monitoring and Evaluation
Macadam	Broken stone of even size, bound with tar or bitumen and used in successively compacted layers for surfacing roads and paths
Maintenance	Cutting roadside vegetation, cleaning drains and culverts, fixing potholes, cracks, rutting, etc, repairing damaged guardrails, road signs etc. Periodic maintenance involves grading gravel shoulders and resealing surface, carrying out more major repairs. Road maintenance specifications are provided in DOWH’s Highway Maintenance Specifications (Department of Works, 2017).
Mitigation	Action of reducing the severity, seriousness, or painfulness of something.
Mitigation hierarchy	A tool which aims to help manage environmental and social risk and is commonly applied in Environmental Impact Assessments (EIAs). Includes a hierarchy of steps: Avoidance, Minimisation, Rehabilitation, Reconstruction and Offset.
Mitre drain	(Also called an offshoot drain) is an open drain designed to divert runoff from a table drain or road shoulder away from a road.
Natural water cycle	Water movement under natural (non-human made) conditions
NCD	National Capital District
NR	National Road
NRN	National Road Network

NRNS	National Road Network Strategy
OHS	Occupational health and safety
OPBRC	Output and Performance-Based Road Contract
Operations and maintenance phase	Following completion of construction of a project and commencement of activities that the project was designed to achieve. It includes the need to ensure that all systems are continuing to run as per the original design.
Operations/operational	Act of implementing “Operations and maintenance phase”.
Outfall drainage	Road surface slopes away from a cut batter or hillside with water flowing evenly to the shoulder of the fill or lower side of the road. This is generally used on moderate slopes for low traffic volume roads and stable soils.
Particulate matter	Are microscopic particles of solid or liquid matter suspended in the air.
PBC	Performance-based maintenance contract.
Pedestrian crossings	Pedestrian crossings are intersections where people on foot have priority. If you are in a vehicle, you must give way to foot traffic at a pedestrian crossing.
Performance-based	Product and services purchasing strategy used to achieve measurable supplier performance.
PNG	Papua New Guinea
Precipitation	Rain, snow, sleet, or hail that falls to or condenses on the ground.
Preliminary ESIA	Environmental and Social Impact Assessment completed during the project Preliminary Design Phase.
Pre-road construction	Local conditions that existed before a road was put in place
Prime coat	A prime coat is the application of a suitable bituminous binder applied to a non-bituminous granular base as a preliminary treatment before the application of a bituminous surfacing.
Project implementation	Moving from project design to mobilisation and constriction.
Public health and safety	
Pull-off bay	Designed, temporary lane allowing vehicles to cars to pull off the road safely and preventing the traffic from having to slow down to allow a car to pull over.
QMP	Quarry Management Plan
Quarry	A quarry is a place where rocks, sand, or minerals are extracted from the surface of the Earth.

Receiving water catchment	Water moving from one area where water is collected by the natural landscape to another downstream catchment.
Reconstruction	Reconstruction is required where the road surface and pavement have completely been destroyed (e.g. part of the Ranges) and the road pavement, surface, and possibly drainage, needs to be completely rebuilt. Steps involved will reflect normal road construction related activities exclusive of the need to clear vegetation.
Rehabilitate	Structural enhancements that extend the service life of an existing pavement and/or improve its structural capacity. For the context of RTP this will normally involve ripping the existing road surface, base course and subbase (if there is one) and recompacting to form a new subbase, then overlaying with a new base course and surface. Horizontal alignment won't change but vertical alignment may change as a result of the RTP.
Repair	Road repairs involves localised maintenance that return the road to a condition where it can continue to be used to allow unconstrained traffic flow. It includes activities such as patching potholes, repairing drains, repairing guardrails etc.
Replace	Replace infrastructure to be the same as the original, 'as built', design.
Resettlement	The act or instance of settling or being settled in another place.
Resilience improvement	Improving the resilience of the entire road profile. This will include raising road embankments in low-lying and flood-prone areas, measures to improve the slope stability of embankments and cuttings to prevent landslips, increased size of longitudinal and cross-drainage to prevent local flooding, by accommodating increased frequency, intensity and duration of storms in the design parameters, and provision of subsoil drainage in cuttings and areas with a high water-table, to increase pavement resilience.
Resurfacing	Road resurfacing is the process of spraying a bitumen product onto a road pavement with the optional addition of a layer of uniformly sized stones to create a new waterproof surface.
Right of way	When one person owns a piece of land that is bordered on all sides by lands owned by others, an easement may exist, or be created so as to initiate a right of way through the bordering land.
Rip rap	Human-placed rock or other material used to protect shoreline structures against scour and water, wave, or ice erosion. Ripraps are used to armour shorelines, streambeds, bridge abutments, foundational infrastructure supports and other shoreline structures against erosion. Common rock types used include granite and modular concrete blocks. Rubble from building and paving demolition is sometimes used, as well as specifically designed structures called tetrapods.
RMRP	Road Maintenance and Rehabilitation Project
Road construction	Involves the use of asphalt, liquid asphalt, concrete, soil stabilization, rebar, paving and pavement recycling machines, and other road repair materials to make roads.
Road crowning	Surface water is drained off the driveway surface by creating a high point that runs lengthwise along the centre of the road. Either side of this high point is sloped gently away from the centre toward the outer edge of the road.

Road easement	A road easement is an easement which allows for the construction and use of a road on a parcel of land by someone other than the property owner.
Road footprint	Area cleared to allow for the construction and operation of a road.
Road formation	The surface of finished earthworks on which a road pavement is constructed. It includes the earthworks, the general shaping of the road and basic drainage, but excluding stormwater infrastructure.
Road furniture/furnishing	All fixtures in the road and road easement. The term includes fixtures on the road surface such as steel covers and traffic domes (silent cops) or lane markers. It includes everything added to verges, roads and footpaths to help direct and influence road user behaviour and to assist pedestrians.
Road infrastructure	All physical assets within the road reserve, including not only the road itself, but all associated furniture (signage etc), and all earthworks, drainage, structures (culverts, bridges, buildings etc).
Road safety audit	Assessment considering issues such as traffic speed, pedestrian movements and crossing points, traffic near sensitive receptors such as schools, dangerous corners, and sections with steep side drop-offs. The Road Safety Audit will involve fieldwork and desk studies. The outputs are “existing situation” – baseline analysis with recommendations for general and specific measures to be included in the designs, and b) designs –review of design reports, drawings and specifications with recommended modifications / additions to incorporate the Road Safety Audit recommendations.
Road safety awareness	Communication programs used to make the readers (usually the community) aware of road related hazards and controls.
Road signage	Signs used to warn or inform motorists of important information (including hazards) to assist the driver to drive in a safe manner and to be aware of unforeseen events.
Roadside drainage	Drainage systems used to remove stormwater off road surfaces making them safer to travel on. Drainage systems usually divert and temporarily capture road runoff in order to allow sedimentation to occur and to not overload downstream catchments and avoid erosion.
Routine maintenance	Maintenance work that is carried out on a planned basis and is usually carried out based on a duration that avoids breakdowns.
RTP	Resilient Transport Project
Safety in design	The integration of control measures early in the design process to eliminate or, if this is not reasonable or practicable, minimize risks to OHS throughout the life of the structure being designed.
Seal (Sealed road)	A sealed road is a road of which the surface has been permanently sealed by the use of one of several pavement treatments, often of composite construction. Treatments can include: • Asphalt concrete;

- Chipseal;
- Tarmac; and
- Bitumen.

Sedimentation dam	A mitre drain (also offshoot drain) is an open drain designed to divert runoff from a table drain or road shoulder away from a road.
SEMS	Social and Environmental Matters of Significance e.g. particularly flora, fauna, socio-economic values, surface water and freshwater ecosystems, groundwater, soils.
Sensitive receptors	Means a receptor that is affected by slight differences or changes in environmental conditions.
Slope stability	Condition that an inclined slope can withstand its own weight and external forces without experiencing displacement.
Social specialist	Person commissioned to ensure that social management of the project meets the conditions and commitments that the project prescribes to.
Socio-economic	Matters relating to economic activity affects and is shaped by social processes. In general socio-economics involves the analysis of how modern societies progress, stagnate, or regress because of their local or regional economy, or the global economy.
Solid waste	Any garbage or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, resulting from industrial, commercial, mining, and agricultural operations, and from community activities.
Speed humps	A class of traffic calming devices that use vertical deflection to slow motor-vehicle traffic in order to improve safety conditions. Variations include the speed hump, speed cushion, and speed table.
Stakeholder Engagement Plan (SEP)	Plan for communicating with people with a significant stake in a project. It can involve consultation, awareness, feedback etc.
Stockpile	A large quantity of materials that have been stored for future use. For example gravel, aggregate, sand etc.
Stormwater	Stormwater is rainwater that runs off hard surfaces like roofs and roads and is carried away by stormwater drains flowing into local waterways.
Support structures	Structure that serves to support something. In the context of the RTP this can include support for infrastructure as well as slope and ground support.
Surface water	Water on the surface of the land.
Surveys	A method of gathering information from a sample with the intention of using the results to predict what is present in a larger data set or for what to expect to be found under areas with similar conditions. Surveys provide a critical source of data and insights.

Sustainable maintenance	Maintenance that meets the needs of present without compromising the ability of future generations to meet their own needs. Sustainable maintenance practices are practices of high quality aimed at increasing process performance with improved/enhanced functionality of its components using secure technologies and methods utilizing optimal resources by reducing or eliminating downtime, mean time to repair (MTTR) and products' wastes thereby providing maximum usability and reusability of parts/components, enhanced production benefits, economic impact and making the enterprise to stand competitively.
TA	Technical Assistance
Table drains	Table drains are excavated open channels that are built parallel to roads and tracks. These drains direct runoff to disposal areas further downslope.
Tarmac	Material used for surfacing roads or other outdoor areas, consisting of broken stone mixed with tar.
TA	Technical assistance is any form of professional help, guidance or support for "others" to be more effective in the performance of their functions. Technical Assistance is conducted to help, solve problems, improve performance, get results, and gather data to inform policy formulation.
TMP	Traffic Management Plan
Toxicity	Toxicity is the degree to which a chemical substance or a particular mixture of substances can damage an organism.
Traffic safety mitigations	Controls that are put in place to improve the safety of road operations to drivers as well as pedestrians.
Transport Sector Support Program	TSSP
Transport Service Provider	Transportation service provider means any Person whose primary business is (i) the provision of transportation to or for occupants in Vehicles, (ii) the provision of hardware, software or connected services (or combinations thereof) to enable Occupants to access and use software or connected services for or within a Vehicle or (iii) the provision of Vehicles used for the transportation of Occupants.
Trial pit	A type of intrusive ground investigation that is used as a means of determining the condition of the ground, typically before beginning construction works. Trial pits are commonly used to investigate shallow ground conditions to develop an understanding of the profile of soils within the ground.
Unstable slopes	Slopes considered unstable due to their incline (or critical angle of repose) often applied to slopes made of unconsolidated material. Unstable slopes are prone to failure in the form of rockfalls, rock flows, plane shears, or rotational shears. Unstable slopes are typically prone landslides.
Upgrade	Improve infrastructure from the 'as built', original design. For example, change road surface from dirt to bitumen.

Ward	A division or district of a city or town, as for administrative or political purposes.
WASH	Water Sanitation and Hygiene
Waterway	River, creek, stream or brook, including its floodplain and estuary.
Wetland	A series of shallow, densely-planted, ponds that help filter water through physical and biological processes. They provide a natural way to treat and remove pollutants from stormwater before it enters our creeks, rivers and oceans.
Whoa boy	(Sometimes called check, cross, or roll over banks) Trafficable diversion banks. They are constructed to divert water off the track without causing erosion and allowing vehicles or people to cross over them. Banks of different shapes and heights are used depending on the situation and the water diversion requirement.
Worker camp	Temporary camps used to housework crews during the construction phase.
Worker health and safety	Concerned with the safety, health, and welfare of people at an occupation.
Zero-budget disaster recovery contingency fund	A financial safety net for future mishaps and/or unexpected expenses.

1 Introduction

1.1 Implementing Agency

The Department of Works and Highways (DOWH) is responsible for maintaining national roads. Analysis of annual funding needed to provide effective and timely maintenance of roads indicates that there is an 80 percent shortfall. This has resulted in significant deterioration of rural roads over time.

DOWH has developed a draft National Road Network Strategy (NRNS) to find a sustainable way of maximising the impact of funding for PNG's national road network totalling 8,738 kilometres. The NRNS responds to the critical shortfall in funding levels by prioritizing restoration and sustainable maintenance of a 2,309 kilometres Core Road network comprised of the eight most vital roads to sustaining key industries, exports, inter-modal connectivity, and government functions. The NRNS attempts to improve the efficiency of maintenance contracting by adopting a shift to long-term performance-based maintenance. This includes contracting of road maintenance to the private sector, strengthening small and medium-sized contractors, and encouraging participation of local communities in routine maintenance of roads (The World Bank, 2021).

The DOWH has a set of Highway Maintenance Specifications that serve as the standard baseline in up keeping the roads infrastructure in PNG and as a guide to maintaining current road assets. The Maintenance Specifications are incorporated into all maintenance contract agreements between the DOWH as the Contracting Agency and the Contractor. They set out the general requirements for the performance of maintenance operations on roadways and bridges under its jurisdiction (Department of Works, 2017).

The proposed implementation arrangements will involve the DOWH as the single Implementation Agency. DOWH has an established Environmental, Social, and Safety Safeguards Branch (ESSSB) and will retain the support of an international environmental specialist and a social specialist to assist in preparation of the final environmental and social instruments and their implementation during project implementation.

1.2 Context

PNG has a fragmented road network. Connectivity between rural communities is poor, as they are spread across the country's rugged inland terrain and dispersed over many islands, increasing the cost of business, building infrastructure, and service delivery. For example, it is not possible to travel by land between most provinces or ports. In parallel, the road network direly needs improvement with only 38 percent of all national roads sealed and less than 10 percent of national roads being in good condition.

It is estimated that only 68 percent of the rural population lives within two kilometres of an all-season road. The Highlands Region, for example, is virtually landlocked and some people may be required to walk more than 4 hours to reach the nearest road. Even while air, water, and maritime transport play a critical role in parallel to road transport, intermodal integration and coordination remains a challenge (The World Bank, 2021).

Three quarters of the country's road network becomes impassable at some point during the year, while the overall condition of the road network is declining due to lack of investment and maintenance. Since the 1990s, annual funding for road maintenance and restoration of national roads has been in the order of 20 percent of estimated needs. Reliance on small, input-based road works projects has spread limited funding too thin to sustain critical road links and failed to leverage commercial incentives to organize maintenance work efficiently. Roads are also not surveyed regularly, or with a consistent approach (The World Bank, 2021).

Road safety is a major concern throughout PNG. The rate of road fatalities (16.8 deaths per 100,000 population) is estimated to be the second highest in the South Pacific region (about three times higher than Fiji). Pedestrians account for 29 percent of road traffic fatalities. While reliable road crash statistics are not available, anecdotal evidence suggests a high incidence of accidents on account of speeding, drunk driving, and unsafe roads and vehicles. The DOWH, which has responsibility for management of the National Road Network (NRN), has established an interdisciplinary road safety committee and has recruited a road safety engineer in its Design division. Safety for

women on public transport is also a concern, besides the overall high prevalence of Gender Based Violence (GBV) in PNG (The World Bank, 2021). Other road safety related concerns include a culture of speeding; poor condition of roads and vehicles; driver behaviour (including drunk driving); lack of awareness of road safety at all levels; and inadequate safety for women on public transport.

PNG is highly vulnerable to the effects of climate change (especially, extreme precipitation and flooding, intense storms, causing landslides, coastal erosion), as well as other natural disasters, including earthquakes, which contribute to an increased need for maintenance, repairs and reconstruction. Such events can cause disruption and damage to the network and pose a risk to the project outcome and service delivery. Future changes in climate will exacerbate such issues and can lead to deterioration of the network.

The World Bank and other development partners have invested in infrastructure and capacity building to the road sector. However, much remains to be done to bring the network into a satisfactory condition. In 2017, the Asian Development Bank (ADB) approved and is implementing a US$1 billion investment program over ten years to support a performance-based maintenance approach for the Highlands Highway, the country's most economically significant road corridor. Since 2018, Australia's Department of Foreign Affairs and Trade (DFAT) has funded the second phase of the Transport Sector Support Program (TSSPII) to support reforms in the road sector, including:

- overall coordination of road sector reform;
- regulatory and institutional reform to reduce inefficiencies in the sector including support to the newly established Road Fund; and
- institutional support to introduce more effective and efficient road management practices (The World Bank, 2021).

Since 2002, the World Bank has been supporting the road sector in PNG through the two investment operations. The Roads Maintenance and Rehabilitation Project (RMRP) was approved in 2002 and closed in 2012. The RMRP2 was approved in 2011 and is under implementation as of January 2022. Both projects support rehabilitation and maintenance of the national road network. In particular, RMRP2 supports "Output" and "Performance" Based Road Contract (OPBRC) for maintenance of 110 kilometres of the Hiritano Highway in Central province. This contract was initiated as a pilot project to test whether the performance-based routine maintenance of a national highway in PNG could be financially, contractually, and operationally successful. There is clear evidence in this regard on all three of these criteria. The length was increased to 125 kilometres in 2020 and the contract has now been extended until April 2023 (The World Bank, 2021).

The proposed project, RTP, will improve road conditions, safety, and resilience of two core roads: Ramu and Hiritano highways. The project will reduce the cost of business, building infrastructure, and service delivery and ultimately promote inclusive growth, reduce poverty, and boost shared prosperity. The Government of PNG (GoPNG) has requested World Bank support to expand OPBRC contracting along the Ramu and Hiritano highways, both of which are prioritized as Core Road links by NRNS.

The Ramu Highway forms the primary connection between Madang and Lae city ports, and connects those cities to the Madang, Morobe, and Eastern Highland provinces. The Highway supports important mining and agro-industrial activities in the region, specifically beef, sugar, and palm oil production. It also is one of the only roads providing port access to the Highlands Highway that provides connectivity to all of the Highlands provinces (The World Bank, 2021).

RTP will support sustainable road infrastructure through OPBRC. The current poor condition of the highway restricts businesses in moving products as some of its sections are not trafficable by heavy vehicles. Businesses in the Ramu and Markham Regions are incurring higher transports costs by shipping produce to Madang through Lae Port to avoid the significant risks involved with transportation via the western sections of the Ramu Highway. The project supports expanding the Hiritano OPBRC pilot by 22.5 kilometres to include chainage from Laloki to Brown River and bringing the entire 175 kilometres length of the Ramu highway under a four-year OPBRC. Contemporaneously, ADB is utilizing OPBRC-type contracts in its multi-tranche, 500 kilometres-long Sustainable Highlands Highway Investment Program. The RTP's technical assistance provision, along with capacity building support during the preparation stage, could help mitigate some of these anticipated challenges by strengthening its project management skills and improving institutional efficiency (The World Bank, 2021).

1.2.1 Ramu Highway

The Ramu Highway forms the primary connection between Madang and Lae city ports, and connects those cities to the Madang, Morobe and Eastern Highland provinces.

The poor condition of the Ramu Highway restricts businesses from moving products as some of its sections are inaccessible by heavy vehicles, such that businesses in the Ramu and Markham Regions would generally prefer to ship produce to Madang through Lae Port in order to avoid the significant risks involved with transportation via the western sections of the Highway, and thereby incurring higher transportation costs.

The Ramu Highway passes through the Ramu Range. This area is particularly challenging because of (i) unstable slopes causing frequent and slow-moving landslips, (ii) very steep gradients requiring vertical realignment and/or climbing lanes, (iii) a slurry pipeline which runs adjacent to the road, and (iv)numerous drainage-related problems. These issues, which are also exacerbated by climate change effects.

Sections of the Ramu Highway have undergone rehabilitation and maintenance over the last 10 years including an ADB financed project to reconstruct major bridges (completed in 2017) and DFAT funded maintenance – currently ongoing and due to be completed in 2022. DOWH has also just secured funds through Connect PNG for emergency repair works for Ramu range section due to commence in 2022.

The Ramu-Madang Highway remains a critical element of infrastructure for the Government's long-term plan to develop road infrastructure along an economic corridor on the north coast of the country to the border with Indonesia.

1.2.2 Hiritano Highway

The Hiritano Highway is a major economic corridor between Gulf Province and Port Moresby. Over the past two decades, GoPNG, with support from World Bank and ADB, has committed significant funds in upgrading significant portions of each highway's total length to a bitumen sealed surface, and to upgrading or replacing several important river bridges.

Implementation of the current World Bank-funded RMRP II will end in April 2023. That project currently includes two contracts on the Hiritano highway; the upgrade to seal from Epo to Kerema (10 kilometres) in Gulf Province, and the performance-based maintenance from Brown River to Bereina (126 kilometres) in Central Province.

1.3 Project Overview

The World Bank (WB) funded Papua New Guinea (PNG) RTP (P166991) has been developed to enhance the resilience and safety of priority road infrastructure and strengthen institutional capacity in the road sector. The RTP has been designed to:

- Be aligned with the current Country Partnership Framework (CPF (FY2019-FY2023));
- Be aligned with the World Bank Group's commitment to support unit countries experiencing, protracted institutional fragility;
- Support key elements of the Government's Vision 2050, the PNG Development Strategic Plan 2010-2030, and the third Medium-Term Development Plan III (MTDPIII, 2018-2022); and
- Be focused on maintenance and rehabilitation of the core road network and related institutional capacity development aligning it with the NRNS (The World Bank, 2021).

The RTP includes the three components:

(i) resilience improvement and sustainable maintenance of priority national highways;

(ii) institutional strengthening, project management, and technical assistance; and

(iii) Contingency Emergency Response Component (CERC).

The project involves the following components and activities:

1.3.1 Component 1: Resilience Improvement and Sustainable Maintenance of Priority National Highways:

This component will finance rehabilitation of a combined 64-69 kilometres of the Ramu and Hiritano Highways and finance maintenance of approximately 200 kilometres of road.

1.3.1.1 Component 1.1 Ramu Highway

This subcomponent will finance a single contract for design and reconstruction of 40-45 kilometres of the road and performance-based maintenance over a five-year period covering the full length – approximately 175 kilometres – of the Ramu Highway, from Waterais junction in Morobe province to Madang airport junction in Madang province.

The project will also address the following problems on the Ramu Range section, some of which are also related to the climate change risks to the road:

- unstable slopes causing frequent and slow-moving landslides;
- very steep gradients requiring vertical realignment and/or climbing lanes;
- the risk of accidental damage (including leakage and spillage) to the slurry pipeline which runs adjacent to the road; and
- numerous drainage-related problems.

Climate change including extreme weather events could further exacerbate these issues, and during project preparation, appropriate measures, such as the development and/or application of climate resilient norms, will be included in the design of works .Component 1.2 Hiritano Highway

This subcomponent will finance the design, supervision, and rehabilitation of the heavily trafficked 22.5 kilometres section between Laloki River (on the boundary of the National Capital District) and Brown River under a design, build and performance-based maintenance contract, which will complete and extend the work under the ongoing RMRP2 on the Hiritano Highway (The World Bank, 2021). kilometres

1.3.1.2 Component 1.3 Road safety and community facilities

The subcomponent will finance countermeasures to reduce road traffic crashes injuries, and fatalities on the Ramu and Hiritano highways, including better enforcement of regulations (speed limits, vehicle inspections, etc.). It will also support a road safety management capacity review to map out the situation, identify key stakeholders, and propose actions to improve road safety outcomes in the country. Activities under the safe system approach encompassing safe road users, safe vehicles, safe speeds, safe roads and roadsides, and post-crash care will be further developed during the project implementation.

The project would also contribute to improving the quality and safety of pedestrian facilities along both the roads and bridges, and implement targeted traffic safety campaigns and awareness measures, prioritizing the needs of women traders working in roadside markets and school children who use the roads as pedestrians. As part of broader COVID19 protection measures, opportunities will be identified to install Water Sanitation and Hygiene (WASH) facilities whose broad health and hygiene impacts also include protection against COVID-19 and other infectious diseases (The World Bank, 2021).

1.3.2 Component 2: Institutional Strengthening, Project Management and Technical Assistance:

This component would finance:

- the establishment and operating costs of an Employer's Project Manager (EPM) within DOWH, including specialists in the area of project management, safeguards, procurement, contract management and financial management and M&E; and
- A range of institutional strengthening initiatives to support management and technical skills development in the road sector, including support to OPBRC contracting.

As part of the institutional strengthening initiatives, the project would support the GoPNG to implement, in close coordination with other development partners, the sector reform agenda embodied in the Road Fund and Management Act, 2020, especially for reliable funding for multi-year road maintenance contracts. This TA program will be formulated and implemented alongside the institutional restructuring of DOWH. This support would be further discussed with DOWH and may include technical assistance (TA) for:

- preparation of a OPBRC for the preservation and maintenance of the entire Hiritano Highway corridor and other national highways in the Southern region;
- Road Asset Management System enhancements and strengthening of Quality Assurance/Quality Control for construction and maintenance works;
- strengthening environmental and social risk management; and
- other training and capacity building opportunities to strengthen the capacity of DOWH and the Road Fund to manage PNG's road network (The World Bank, 2021).

1.3.3 Component 3: Contingency Emergency Response Component (CERC)

This component would finance emergency response to an eligible crisis or emergency should the GoPNG so request the support of the World Bank to reallocate resources towards that effort (The World Bank, 2021).

1.4 Project Beneficiaries

The primary project beneficiaries are the road users and transport service providers utilising the two highway corridors, who will benefit from the rehabilitation, and road safety improvements, including better road quality and level of serviceability, lower vehicle operating costs, and time savings. These beneficiaries include firms located along the road and connecting routes, and farmers living and working along the Ramu and Hiritano Highway road easement. The project will also provide improved access from the national road to numerous communities in Madang and Morobe Provinces, linking communities to broader markets, especially for agricultural products and commercial goods. It will also reduce transport costs and improve road safety for all road users. The proposed project will provide employment to the local communities, specifically targeting women in routine road maintenance and OPBRC activities allowing more of them to take part in the DOWH workforce (The World Bank, 2021).

1.5 ESIA Scope and Development

1.5.1 Purpose

This ESIA assesses the potential risks and impacts associated with the project activities and outlines appropriate mitigation measures. This ESIA has been developed during the Preliminary Design Phase and is preliminary in nature. At the Preliminary Design Phase the final alignment is not fully defined and the exact locations where works will be needed have not been verified in the field and the details of work requirements are also not fully defined. To the extent possible, without the completion of Detailed Design, this document identifies project activities, sites, surrounding areas, environments and people affected by the RTP, assesses the risks and impacts, identifies the measures to eliminate or offset adverse E&S impacts, or to reduce them to acceptable levels and the actions needed

to implement these measures, and identify any further investigations required for specific impacts and management measures to be undertaken when preparing a Final Project-wide ESIA during implementation.

1.5.2 Content

Under the World Bank's Environmental and Social Framework (ESF), an ESIA is required for RTP works.

This ESIA identifies key risk areas and highlights uncertainties requiring further, more quantitative investigations.

After briefly describing the project area, the document goes on to address the following issues:

2. Activity location
3. Policy and legal framework
4. Baseline environmental and social context
5. Activity description
6. An assessment of the potential environmental and social impacts of the Project
7. Proposed mitigation strategies to control impacts identified. This will form the basis for the ESMP and guide the preparation of the Contractors CESMP
8. Complaints and grievance system
9. Stakeholder engagement
10. Capacity development and training
11. Incident management and emergency response
12. Arrangements for implementation, including roles and responsibilities, monitoring and reporting procedures to be used for the preparation and implementation by the Contractor through a CESMP.

A number of studies and assessments exist and have been reviewed in the development the Preliminary ESIA. Key documents include: i) initial environmental examination (IEE) and resettlement action plan (RAP) for six bridges that are currently being rehabilitated by the ADB on the Ramu and Hiritano Highways (2011); ii) a preliminary environmental assessment, social assessment, and Resettlement Framework (2015) to support the scoping phase of the Ramu Highway Joint Venture Project which aims to improve road geometry and pavement condition to enable a viable transport link between Madang Port and the Ramu Valley; and iii) an environmental management plan (2011) for the RMRPII financed Hiritano Highway Rehabilitation.

1.5.3 Final ESIA

This Preliminary ESIA has been developed during Preliminary Design Phase. It is a screening document that has been developed before a clear understanding of the locations where Reconstruction, Repair, Rehabilitation and Maintenance activities will take place.

For the Detailed Phase further targeted field surveys and impact assessments will be needed after the locations where Reconstruction, Repair, Rehabilitation and Maintenance works involving road widening or realignment, cross water bodies (or are upstream of significant waterbodies which could be at risk of becoming contaminated) have been identified.

The Final ESIA will include the outcomes of site-specific surveys and impact assessments that have been identified in this Preliminary ESIA. Mitigation controls identified will need to be included in the E&S Management Plan and associated sub-plans.

The following activities will need to be completed to upgrade this ESIA from Preliminary to Final:

Environmental

1. **Topography, geology and soils**: Field surveys will be needed to confirm the quality and quantity of soils and detail the local topography in areas where Reconstruction, Repairs and Rehabilitation works will be required and are at risk of landslides (e.g. Ramu Ranges) or where excavation works will be required. The Final ESIA should define existing conditions, qualify and quantify potential impacts and propose controls to mitigation the impacts (such as slope support structures). The project is proposing to carry out Scala/DCP testing, trial pits and core drilling to supplement this information (refer to Section 3.2).

2. **Water resources**: Field surveys will be needed at areas where downstream areas are at risk of being impacted by Reconstruction, Repair and Rehabilitation works (such as from erosion and sedimentation, heavy metal or hydrocarbon pollution etc.). Field Surveys should focus on areas where Reconstruction works are likely to impact downstream catchments such as the Ramu Ranges, where steep terrain can result in significant erosion. The Final ESIA should identify downstream water and groundwater users located along the road easements that are at risk or Reconstruction, Repair and Rehabilitation works ensuring that they are considered in Detailed Design. This will require consultation work with the key stakeholders (such as the Department of Health, CEPA, Department of National Planning and Rural Development, local community representatives) to identify water users, how the water is used and to understand the impacts of the project on these water sources. The impacts on water resources will need to be assessed based on the level of risk and the existing conditions, impacts and controls shall be included in the Final ESIA.

3. **Waste**: During Detailed Design, locations where waste can be taken to service the RTP's construction requirements should be identified as part of Detailed Design Phase and the existing conditions and potential impacts and controls should be summarised in the Final ESIA.

4. **Quarry and gravel**: A review will be undertaken to identify locations where stone materials can be secured; either from existing sources (such as operating quarries) or from new sources identified during the review and the logistics associated with securing the materials and transporting it to point of use shall be determined. Where there are gaps in supply needed for the RTP, investigations will be undertaken to establish new quarries/borrow areas. Before developing any new quarry, an impact assessment will be required and, where Division 2, Section 44 of the *Environment Act* is triggered, an environmental permit will need to be obtained from the GoPNG prior to constructing the quarry. A checklist will be developed noting what the contractor must do for established quarries and for new quarries (including the requirements of any environment permits). The details of the quarries and the impact assessment for them will be included in the Final ESIA. The controls are to be integrated into the Sub-Project Quarry and/or Gravel Extraction Management Plan.

5. **Associated Facilities**: Quarries are considered an "associated facility" under ESS1 and the impact assessment (new quarries) and contractor quarry management plan (all quarries) must be approved by the World Bank prior to the commencement of works. The final ESIA will identify and assess, to the extent appropriate, the potential environmental and social risks and impacts of Associated Facilities (AF). AF need to meet the following three criteria: a) directly and significantly related to the project; (b) carried out, or planned to be carried out, contemporaneously with the project and (c) necessary for the project to be viable and would not have been constructed, expanded or conducted if the project did not exist. The GoPNG will address the risks and impacts of AF to meet the requirements of the ESSs, to the extent that the government has control or influence over such AF

6. **Flora**: Field surveys will be needed at areas where native flora will need to be cleared (for example from the construction of Climbing Lanes, road realignment or installation of slope stability controls or stormwater management controls) for Reconstruction, Repair and Rehabilitation works. The Final ESIA should describe the existing condition of vegetation to be cleared and identify rare and endangered species that could be at risk assess the impacts, identify controls to prevent significant impacts and conclude if any impacts are acceptable. Where controls are identified in these surveys, they will be integrated into the Biodiversity Management Plan (BMP) (refer to *Section 7 E&S Management*).

7. **Freshwater aquatic systems**: Field surveys will be needed where downstream areas are at risk of being impacted by Reconstruction, Repair and Rehabilitation works (such as from erosion and sedimentation, heavy

metal or hydrocarbon pollution etc.). Field Surveys should focus on areas where works are likely to impact downstream freshwater aquatic habitats (such as where Reconstruction and Repair works are to occur at significant waterway crossings (refer to *Section 5.1.3 Water resources*)) and identify and assess the impacts of the works. The Final ESIA should describe the existing condition of freshwater aquatic habitats potentially impacted, identify rare and endangered species and locations where aquatic species are harvested that could be at risk, assess the impacts, identify controls to prevent significant impacts and conclude if any impacts are acceptable. Where controls are identified in these surveys, they will be integrated into the Biodiversity Management Plan (BMP) (refer to *Section 7 E&S Management*).

8. **Fauna**: Habitat assessment surveys will be needed at areas where there are potential Red List species habitats and they may be at risk of being disturbed (for example from the construction of Climbing Lanes, road realignment or installation of slope stability controls or stormwater management controls) from Reconstruction, Repair and Rehabilitation works. The Final ESIA should identify any potential IUCN Red List species habitats that could be at risk, assess the impacts, identify controls to prevent significant impacts and conclude if any impacts are acceptable. Where controls are identified in these surveys, they will be integrated into the Biodiversity Management Plan (BMP) (refer to *Section 7 E&S Management*).

9. **Conservation areas**: Further assessments would be required where road works (such as passing climbing lanes) and drainage structures would be constructed near conservation areas. Where new clearing is required within close proximity to Wildlife Management Areas, Conservation Areas, National Parks and Protected Areas or any area declared to be protected under the provisions of an International Treaty to which PNG is a party and which has been ratified by the Parliament of the Independent State of PNG, the impacts shall be assessed. If there are likely to be "a significant risk of serious or material environmental harm" to one of these areas an EIA will need to be conducted in accordance with Division 3 of the *Environment Act* and Ministerial approval required before commencing any activities. Where controls are identified in these surveys, they will be integrated into the Biodiversity Management Plan (BMP) (refer to *Section 7 E&S Management*).

Following completion of these targeted surveys and assessments the final ESIA shall also include performance indicators targeted on significant issues and mitigation controls identified. The performance indicators should be linked to a bonus/penalty structure within bidding documents to encourage high level performance.

Each of these field surveys and assessments are to be undertaken by consultants qualified and experienced in the relevant subject matter:

- Topography, geology and soils – geotechnical engineering consultant;
- Water resources – civil engineering/hydrology consultant;
- Waste, quarry, gravel – civil engineering/environmental consultant; and
- Flora, fauna, Freshwater aquatic ecosystems, conservation areas – ecological consultants.

Social

10. **Land acquisition and resettlement assessment** – will be conducted including confirmation of the status of the road corridors; conduct of meaningful consultation with affected people for any areas that require corridor to be established or expanded; confirmation of resettlement impacts. This work will inform resettlement planning requirements, to be conducted in accordance with the project's Resettlement Framework.

11. **Engagement with project affected communities/indigenous peoples and Socio-economic Surveying**: Identify/confirm community groups (the local people are indigenous) and community representatives to consult with during project preparation (and implementation); Conduct socio-economic surveying with project affected wards and villages to collect up-to-date socio-economic baseline information; and conduct

consultation, disseminate information and seek feedback from these communities on the potential impacts and opportunities arising from the project and how these can be managed.

Relevant social assessments and studies are to be undertaken by qualified and experienced social assessment practitioners.

Other

12. **Capacity Assessment -** Conduct a capacity assessment and outline a capacity building plan for supporting and developing DOWH E&S management functions during sub-project design, construction and operation and maintenance.

2 Activity location

2.1 General

PNG is located in the southwestern Pacific Ocean, with a population of around 8 million inhabitants in 2016. The country covers an area of approximately 460,000 kilometres^2 and comprises of the eastern half of New Guinea island, four additional islands (Manus, New Ireland, New Britain, and Bougainville), and 600 smaller islets and atolls of various sizes. The country is divided into four regions including the Highlands, Momase, Southern and Island regions.

The RTP will finance works associated with the Ramu Highway located in the Momase region; and Hiritano Highway located in the Southern Region.

2.2 Ramu Highway

The Ramu Highway (National Road (NR) 13) is 175 kilometres long and forms the primary connection between Madang and Lae city ports and connects the cities of Madang, Morobe and Eastern Highland provinces (Figure 2-1). After following the coast for 20 kilometres the road turns inland to pass through a saddle between the Finisterre and Adelbert Mountains. From here it descends to the Ramu River valley which is an extension of the Markham valley tectonic depression. Where the highway meets the Ramu Valley it turns to the southeast to follow the valley to the Morobe border into Indonesia controlled West Papua (PNG Department of Works, 2011). The highway meets the Highlands Highway at Watarais where it is 160 kilometres to the port of Lae and 120 kilometres to Goroka in the central highlands.

Figure 2-1 Ramu Highway

The Ramu Highway subprojects involved in the RTP are shown in Figure 2-1

Table 2-1 Ramu Highway subprojects summary

Section		Approx. Length	Topography	General condition	Land use	Possible Treatment
1	Waterais Junction / Yokia Bridge	60 kilometres	Ramu valley – flat	Fair to good	Commercial agriculture (oil palm / sugar / cattle)	Repair & maintain
2	Yokia Bridge / Usino Junction	45 kilometres	Ramu valley – flat	Fair to good	Grassland	Repair / rehab & maintain
3	Usino Junction / Tapo Ford	40 kilometres	Ramu range – rugged	Poor to fair	Grassland / forest	Reconstruct & maintain
4	Tapo Ford / Madang	30 kilometres	Coastal plan – undulating	Fair to good	Cultivated	Repair & maintain
	Total length	175 kilometres				

The details of the alignment, works to be carried out and the construction footprint will be determined following detailed design.

2.3 Hiritano Highway

The Hiritano Highway is a nationally gazetted highway in the Central and Gulf Provinces, with a total length of 304 kilometres (Figure 2-2). It runs along the south-western border from Kerema Town in the north to Kupiano in the south connecting with Port Moresby. A number of sections of the Hiritano Highway are being rehabilitated and maintained under RMRP II. The RTP project will continue this work between Brown River and Laloki River in Central Province.

The Hiritano Highway (Brown River – Loloki River) subproject will include rehabilitation and maintenance. The detail of works and construction footprint will be determined following detailed design.

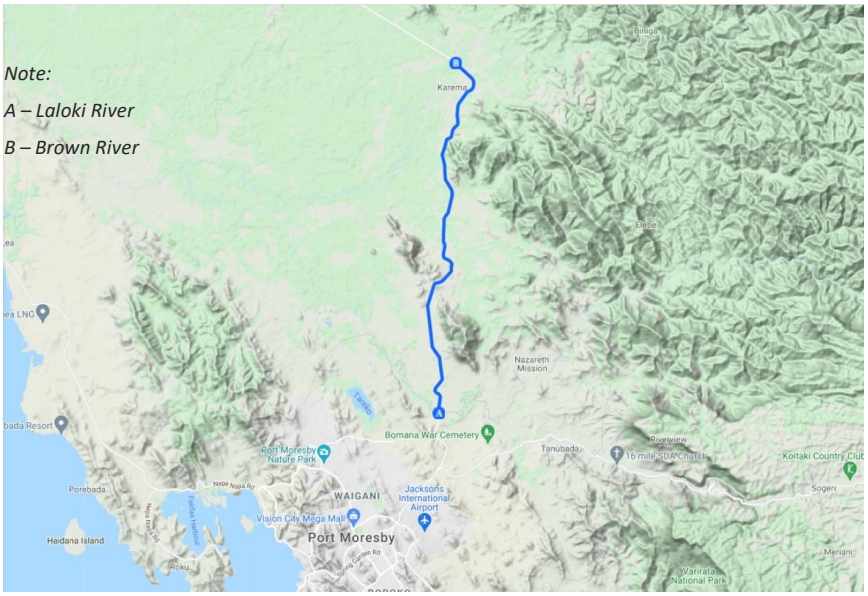

Figure 2-2 – Hiritano Highway

The details of the alignment, works to be carried out and the construction footprint will be determined following detailed design.

2.4 Area of influence

An area of influence will be defined for the final ESIA. The area of influence (AoI) indicates where and to what extent the project may have direct and indirect impacts. The AoI takes into account the physical, biological, ecological, socioeconomic, health and labour conditions that could be impacted by the project. For road related projects direct impacts relate to the road easement whereas the indirect impacts will depend upon:

- The distance from communities (settlements) and sensitive receptors within those communities (e.g. hospitals, places of worship, schools etc.);
- The distance from biological and ecological values (such as threatened species, populations and ecological communities, parks, migratory habitat, foraging habitat);
- Receiving water catchments (surface and groundwater); and
- Feeder roads.

The impacts of roads typically extend several metres from the edge of the road, progressing further where waterways are involved. Key waterways crossed by the Highways within the RTP scope include:

Key named rivers crossed by the Ramu Highway include:

- Ramu River
- Nuru River; and
- Gogol River.

Key rivers crossed for the Hiritano section include:

- Laloki River; and
- Brown River.

The reconstruction work will occur through Ramu Range, and it will cross the Nuru River.

Furthermore, both noise and dust can penetrate further beyond a few metres from the edge of the road, particularly where settlements occur.

Settlements within the AoI will include, as a minimum:

- Approximately 21 communities within a 1 kilometre buffer of the key section of the Hiritano Highway, including a mix of urban settlements and villages (over three wards)
- Communities within 14 wards of the Ramu Valley section of the Ramu Highway
- Communities within 3 wards of the Ramu Range section of the Ramu Highway.

The AoI will be confirmed during detailed design and updated in the final ESIA.

3 Activity description

3.1 Purpose

The objective of RTP is to enhance resilience and safety of priority road infrastructure and strengthen institutional capacity in the road sector. The main beneficiaries of the project will be the local communities and businesses along the selected road alignments, transport sector providers and local contractors.

As stated in *Section 1.3 Project Overview*, the focus of the RTP is to enhance climate resilience of priority road infrastructure and strengthen the road transport institutional framework while maximising their positive impacts on other economic sectors.

3.2 Design

As stated in Section 1.3, the work will primarily involve rehabilitation of a combined 64-69 kilometres of the Ramu and Hiritano Highways and finance the maintenance of approximately 200 kilometres of road.

Design work is preliminary at this stage. Studies need to be undertaken to define required road maintenance requirements, road improvements, geometric design, road widening, pavement design, road furnishing and ancillary works, drainage study, and slope stabilisation prior to the Detailed Design Phase.

To better understand existing conditions and to determine the likely E&S impacts of the RTP, a topographic survey backed up with field survey investigations involving Scala/DCP testing, trial pits and core drilling will be caried out. When the detailed design is completed the E&S impacts will need to verified.

The field survey and investigation works will only apply to the Ramu Highway because the Contractor will be delivering a performance-based maintenance contract (PBC). This creates a requirement for the Contactor to understand the condition of the road before they can bid for maintenance. The complexity of the road reconstruction in the Ramu Range also creates a requirement for more detailed information. For the Brown to Laloki section of the Hiritano Highway the roadworks will be less complex and less additional information is required.

Currently, no alternatives have been identified and assessed.

3.2.1 Design considerations

Design works will consider the mitigation hierarchy to eliminate or mitigate the potential E&S risks and impacts.

The underlying assumption behind road maintenance and reconstruction work is to, wherever possible, limit the impact footprint to the road easement. There is likely to be some areas where the alignment or associated infrastructure (such as drainage or support structures) may extend beyond the existing road easement. For example, through the Ramu Range where slope stabilisation is likely to be required. Depending upon the design and location of these works, site-specific investigations may need to be undertaken to ensure that the risks to E&S values are minimised.

Photo 3-1 Unpassable during wet conditions, Ramu Range

During detailed design, as a minimum, the following should be considered to protect E&S values: proximity to natural habitats; minimising terrain and waterway disturbance; energy consumption; minimising the need for earthworks; creating safer conditions for all road users (including pedestrians) (e.g. visibility, turning); minimising the need to secure right of way; avoiding the need to acquire and resettle; indigenous peoples and the effects on their livelihoods; and maximising reuse and recycling of waste.

The road shall be designed with all required measures to ensure a safe environment. This shall include the appropriate road signs, pull-off bays for buses and pedestrian crossings. The design shall ensure that the road alignment does not traverse sensitive areas.

3.2.1.1 Drainage structures

To allow for adequate drainage, the following points need to be considered: the amount of runoff expected to reach the area under consideration; potential flood areas; areas of discharge (e.g. floodways).

The types of structures that will be considered during detailed design could include: road crowning; infall and outfall drainage; drains, culverts and inverts; table drains; mitre drains; sedimentation dams; wetlands; inverts and floodways; and whoa boys[1] (trafficable diversion banks). Some of these structures may need to be constructed outside of the existing road easement (particularly drainage structures such as sedimentation dams, wetlands, drains etc.). Works such as the clearing of drains and minor repairs are considered to be maintenance where any major repairs or replacement works will be classified as rescinstruction.

The design shall focus on maintaining, protecting and improving waterway health and mitigating the impact of development on the natural water cycle. The design shall start from a vision of achieving neutral or beneficial effect on the receiving environment. The success of the design can be demonstrated by the health of the receiving ecosystems. Where possible, attempt will be made to replicate pre-road construction water flows and reduce the risk of water eroding downstream environments, drying out downstream environments, avoiding pooling of water and allowing enough time for the water quality to improve as the sediment drops out of solution.

3.2.1.2 Road safety in design

The concept of “safety in design” is defined as: “the integration of control measures early in the design process to eliminate or, if this is not reasonable or practicable, minimize risks to OHS throughout the life of the structure being designed.” To that end, an inspection of the road corridor will be undertaken during the detailed design phase to identify road safety concerns and to identify opportunities to improve access and increase the level of safety.

The types of road safety concerns likely to be relevant to the Ramu and Hiritano Highways include: inadequate safety assistance for pedestrians; roadside hazards (narrow bridges, trees); one-way bridges which lack warning and regulatory signs; no/few warning signs before schools or clinics; no posted speed limits; and the highway lacks delineation.

3.2.2 Alternatives

Works on the Ramu and Hiritano Highways were selected for financing under this project based on the outcomes of the National Road Network Strategy 2018 – 2037.. Alternative designs and maintenance/rehabilitation/reconstruction methodologies will be considered during Early Project Implementation Detailed Design Phase of the RTP structures where the road designers will:

- Identify options for alternatives on a basis of location, size, technology and design proposed structures
- Identify direct and indirect impacts on Social and Environmental Matters of Significance (SEMS) (particularly flora, fauna, socio-economic values, surface water and freshwater ecosystems, groundwater, soils). Where additional surveys and impact assessments have been completed (refer to *Section 1.5.3 Final ESIA*) opportunities for alternatives should be analysed focusing on mitigating impacts to SEMS.
- Screen options based on the direct and indirect impacts on SEMS to ensure that impacts are as low reasonably achievable (ALARP)

[1] Further information on these road drainage structures can be found in DOW Highway Maintenance Specifications (Department of Works, 2017) and Road Drainage Fact Sheet (Northern Territory Government)

- Consider the full lifecycle of the structures in respect of energy use, particularly with regards to toxicity (human and ecological), acidification, CO_2 emissions, resource depletion, water use, land use, particulate matter emissions and eutrophication.

The 'no action' alternative would result in the further degradation of sealed road sections exacerbating the road safety issues and alternative would contribute to the negative impacts to the socio-economic environment of PNG is not considered an appropriate option under this project.

3.2.3 Preparation of Tender Documents for Design & Supervision and Civil Works

E&S management needs to be incorporated into the tendering process so that the above-mentioned design strategies can be reflected and finally implemented. For road projects, E&S shall be integrated into two types of tendering, i.e. procurement of (a) Supervision Engineer and (b) Contractor for civil works.

The DOWH shall integrate the E&S elements into the tender documents. Table 3-1 below provides references in the contract Bidding Document where E&S should be integrated into the contract.

Table 3.1 checklist for incorporating main aspects of E&S into supervising engineer procurement documents

Part	Section	ESHS content
Part 1 Tendering Procedures	Section II Bid Data Sheet (BDS)	List the key E&S risks identified in the Preliminary ESIA, Stakeholder Engagement Plan (SEP) and Labour Management Procedures (LMP) Include development of Final ESIA, SEP, LMP and sub-project resettlement plans
	Section III Evaluation and Qualification Criteria 3. Qualification Criteria	Include specific evaluation criteria related to E&S including: • Experience with E&S risk management on similar projects • Availability of suitably qualified specialists • Experience leading behavioral EHS programs and providing EHS coaching, mentoring and influencing in construction projects • Experience developing and implementing assurance programs on construction projects Ensure adequate E&S personnel in the Consultant's key personnel e.g., Environmental Specialist, Health and Safety Specialist, Social Specialist, GBV specialist and that they are at an appropriate level in the organizational structure to effectively influence project leadership and strategy.
	Section IV Bidding Forms Appendix B to Financial Part: Bill of Quantities	Ensure adequate items for E&S in the Bill of Quantities such as: • Preparing and supporting the implementation of (including monitoring and assurance) the Final ESIA, SEP, LMP and sub-project resettlement plans • Support, review and approve contractor ESHS management plan development • Supervision of contractor management plan implementation • Capacity building activities (contractor and DOWH)

Part	Section	ESHS content
	Section IV Bidding Forms	Add Tender Forms associated with E&S if additional evaluation criteria or requirements are included. For example: • Historical contract non-performance, pending litigation and history form; • Environmental, social, health and safety performance declaration; • Experience involving implementation of World Bank E&S Standards or equivalent. • Experience involving implementation of similar projects in PNG or similar environments.
Part 3 Conditions of Contract and Contract Forms	Section IX Particular Conditions (PC) Part D (Environmental, Social, OHS Metrics for Progress Reports)	Add clauses associated with E&S if additional requirements are included, e.g. notify any incident, injury, property or environmental damage; report complete details of the incident; and cooperate for investigations.

Table 3-1 Checklist for incorporating main aspects of E&S into contractor procurement documents

Part	Section	ESHS contents
Part 1 Tendering Procedures	Section II Bid Data Sheet (BDS)	List the key E&S risks identified at the Detailed Design stage (in the designs and CESMP). Include CESMP and other specific plans regarding E&S as defined at the Detailed Design stage.
	Section III Evaluation and Qualification Criteria 3. Qualification Criteria	Include specific evaluation criteria related to E&S including: • Historical contract performance • Declaring past E&S performance including suspensions, terminations, litigation, Government notifiable incidents
	Section III Evaluation and Qualification Criteria 4. Contractor's Representative and Key Personnel	Ensure adequate E&S personnel in the Contractor's key personnel e.g. Environmental Officer, Health and Safety Officer, Social and Community Liaison Officer and that they are at an appropriate level in the organizational structure to effectively influence project leadership and strategy.
	Section IV Bidding Forms Appendix B to Financial Part: Bill of Quantities	Ensure adequate items for E&S in the Bill of Quantities such as: • Traffic Management Plan; • Preparing and implementing contractor's CESMP;

Table 3-1 Checklist for incorporating main aspects of E&S into contractor procurement documents

Part	Section	ESHS contents
		• Preparing and implementing Community Consultation Plan and Social and Gender Awareness Plan; • Preparing and Implementing OHS program; • Any other plans required for this ESIA.
	Section IV Bidding Forms	Add Tender Forms associated with E&S if additional evaluation criteria or requirements are included. For example: • Historical contract non-performance, pending litigation and history form; • Environmental, social, health and safety performance declaration; • Average construction worker turnover; and • Construction experience involving implementation of World Bank E&S Standards or equivalent.
Particular Conditions of the Contract	General Contract Conditions	Ensure that possession of site conditions align with resettlement plan schedule
Part 2 Works' Requirements	Section VII Works Requirements	Specific requirements on E&S in addition to those included in the CESMP.
Part 3 Conditions of Contract and Contract Forms	Section IX Particular Conditions (PC) Part D (Environmental, Social, OHS Metrics for Progress Reports)	Add clauses associated with E&S if additional requirements are included, e.g. notify any incident, injury, property or environmental damage; report complete details of the incident; and cooperate for investigations.

3.3 Construction

3.3.1 Construction Activities

The RTP will involve the broad activities described in Table 3-2.

Table 3-2 RTP activities

Name	Activity
Repair	Road repairs involves localised maintenance that return the road to a condition where it can continue to be used to allow unconstrained traffic flow. It includes activities such as patching potholes, repairing drains, repairing guardrails etc.
Reconstruct	Reconstruction is required where the road surface and pavement have completely been destroyed or are in significant disrepair (e.g. part of the Ranges) and the road pavement, surface, and possibly drainage, needs to be completely rebuilt. Steps involved will reflect normal road construction related activities exclusive of the need to clear vegetation.

Rehabilitation	Structural enhancements that extend the service life of an existing pavement and/or improve its structural capacity. For the context of RTP this will normally involve ripping the existing road surface, base course and subbase (if there is one) and recompacting to form a new subbase, then overlaying with a new base course and surface.
Maintenance	Cutting roadside vegetation, cleaning drains and culverts, fixing potholes, cracks, rutting, etc, repairing damaged guardrails, road signs etc. Periodic maintenance involves grading gravel shoulders and resealing surface, carrying out more major repairs. Road maintenance specifications are provided in DOWH's Highway Maintenance Specifications (Department of Works, 2017).

As stated in *Section 1.3.1 Component 1: Resilience Improvement and Sustainable Maintenance of Priority National Highways*: the Ramu Highway will need both Reconstruction and performance based maintenance over a five year period from Waterais junction in Morobe province to Madang airport junction in Madang province.

Hiritano Highway will involve the rehabilitation of the heavily trafficked 22.5 kilometre section between Laloki River and Brown River

3.3.2 Weather conditions

Resurfacing works requires relatively dry weather conditions, as such, the majority of the resurfacing work should occur during the dry season, which normally runs between the months of June and September.

3.3.3 Equipment

Specialised equipment such as cranes and materials may need to be imported for the RTP. It is likely that general construction equipment such as trucks, backactors (backhoes), rock breakers, crushers, loaders, excavators and rollers can be sourced locally. All cargo, whether air or ship, will need to be processed in accordance with GoPNG quarantine and customs laws which require fumigation (proof of) of materials and equipment and declarations by personnel (specifically regarding communicable diseases).

3.3.4 Ancillary operations

Ancillary operations refer to the activities associated with the provision of resources for the road works such as concrete, asphalt and aggregate and the worker's camp/s. All requirements for Ancillary Operations are to be integrated into the CESMP.

3.3.4.1 Aggregate supply

It is anticipated that coronus materials and crushed aggregates required shall be sourced only from approved quarry sites in PNG. The Contractor shall ensure aggregate is sourced from approved/ permitted quarry sources and the existing quarry is operating in accordance with the PNG law. Any new quarry will require approval from the DOWH and Conservation and Environment Protection Authority (CEPA). In addition, the operator of the quarry will require an approved Quarry Management Plan (QMP). DOWH will be responsible to share the information of the quarry sites and their specification to enable the contractor to decide on the appropriate sites to use based on the standards required by the designs and approved by DOWH.

The contractor will be responsible for the quarrying, crushing and transporting the aggregates from the quarry to laydown or stockpile site for processing and eventually to the spot for resealing. The contractor will need to obtain all the necessary quarry approvals, licences and permits and management plans (including but not limited to construction health, safety, E&S construction management plan (HSESMP)) for the extraction works to be developed by the contractor.

The availability of existing, operating quarries will be determined during Detailed Design Phase, as will the need for the establishment of new quarries where supply gaps exist. Before developing any new quarry, an impact assessment will be required and, where Division 2, Section 44 of the *Environment Act* is triggered, an environmental permit will be required from the GoPNG. A checklist will be developed and included in the Final ESIA (based on due diligence of available materials sources, PNG legislative requirements and the World Bank's ESF requirements) noting what the contractor must do for established quarries and for new quarries (including the requirements of any environment permits). Contractors will be required to develop and implement a quarry management plan for extraction from an existing quarry and an ESIA/ESMP for the development and use of a new quarry. The details of the quarries and the impact assessment for them will be included in the Final ESIA.

3.3.4.2 Asphalt, concrete batching

During construction, concrete will be prepared on site in a batching plant mainly for stormwater drainage infrastructure. The batching plant will require sand, aggregate and cement to be brought in. Aggregate will be sought from already opened sites wherever possible. Where new sources are needed, they will be identified during detailed design and included in the final ESIA. No riverbed extraction or dredging is to be used for aggregate.

Asphalt will be required to seal the roads. Materials that may be brought to site that will have environmental implications include: fuel, concrete, asphalt, bitumen and paint thinners.

3.3.4.3 Workers' Camps and offices

It is anticipated that there will be a need for a residential workers camp for the RTP. If a worker's camp is required appropriate land lease arrangements will be made and approved by the Supervising Engineer in conjunction with DOWH. The necessary steps required in the *International Finance Corporation (IFC)/WB Workers Accommodation: Process and Standards Codes of Practice* shall be followed. Should a worker's camp be required, then these guidelines must be adhered to, and updates made to the ESIA and CESMP as appropriate.

3.3.5 Construction laydown areas

The laydown areas generally consist of project offices, storage areas, stockpile sites, crushing plant and asphalt/concrete plant. The contractor will be responsible to secure the most appropriate laydown site/s along the road network. There might be other areas require to establish laydown areas for camps and storage or parking areas for road machines along the route. The main laydown area containing the asphalt plant must be located on a site that is further from residential areas and critical places such as schools. The asphalt concrete (AC) plant must be at least 300m away from residences and at least 150m from waterbodies (Sirap PST, 2021).

At this stage there are no confirmed locations identified for laydown purposes. When the locations are identified, their establishment will need to be approved, included in the CESMP, and managed in accordance with the requirements of this ESIA and the GoPNG.

3.3.6 Haulage roads

Transport to and from the construction sites ancillary operations (such as laydown areas, camps, quarries, concrete batching plants etc.), particularly of materials and equipment, will occur on the existing road network. Deviations will not be tolerated

Haulage routes are unknown at this stage since the location of ancillary operations have not yet been confirmed. The contractor will determine the haulage routes and include in the traffic management plan (TMP) and CESMP. The CESMP shall assess any requirements and any necessary measures will be reflected in the TMP.

3.3.7 Road construction

Key construction activities are expected to include:

- Contractor mobilisation and establishment of camps.

- Establishing quarry / borrow pit / sand and rock extraction sites (in PNG river gravel is used a lot for pavement and aggregate material). Equipment to be used includes but are not limited to excavators, rock breakers, crushers, loaders and trucks.
- Clearing and grubbing along the corridor within approximately 20m width along route (possibly in stages). Equipment to be used includes but are not limited to graders, dozers, excavators, backactors and trucks.
- Construction of road formation. A 200mm thick subbase will be constructed and will be overlain by a 150mm thick (as a minimum) base. Equipment to be used includes but are not limited to graders, dozers, excavators and rock breakers.
- Drainage structures. Equipment to be used includes but are not limited to excavators, backactors, concrete mixers and trucks. Drainage structures are likely to require concrete. As such a concrete batching plant will need to be established.
- Installation of pavement layers involving surface preparation and application of a prime coat and 19mm aggregate seal coat. Material for the pavement will need to be quarried. Equipment to be used includes but are not limited to loaders, trucks, graders and rollers.
- Installation of surfacing. Materials will be secured from quarries. Equipment to be used includes but are not limited to loaders, trucks, bitumen distributors, chip spreaders and rollers.
- Installation of road furniture including application of pavement markings, installation of guideposts (at culverts) and road signs.

All works shall be carried out in accordance with the legislative requirements of the GoPNG and the DOWH Specification for the Road and Bridges Works August 1995 except as otherwise stated (GoPNG and World Bank, 2011).

3.3.8 Decommissioning

Decommissioning will occur on completion of project activities. Key areas to be decommissioned include quarries, laydown areas, camp facilities, and materials stockpiles. Decommissioning will include the: removal of plant, temporary infrastructure and waste; remediation of any hydrocarbon contamination; and the stabilisation and rehabilitation of disturbed land.

The contractor will develop a decommissioning and rehabilitation plan (DRP). The purpose of the DRP is to provide a framework to enable the contractor to rehabilitate the disturbed areas associated with ancillary operations needed to construct the highways into safe, stable, self-sustaining and non-polluting environments. The DRP aims to ensure that areas developed for ancillary operations are cleaned after project completion, decommissioned and rehabilitated to ensure that they do not pose any long-term hazards to public health and safety or to the environment. The decommissioning and rehabilitation plan should include but not be limited to:

- Development of decommissioning and rehabilitation objectives (what will be removed, what will remain, how the area will be treated). The overall vision is to create a safe, stable and non-polluting environment. Objectives should cover both short-term activities (such as noise, dust, erosion and sedimentation from earthworks) as well as longer term activities such as vegetation re-establishment.
- Stakeholder consultation to confirm what they would like to see with regards to decommissioning and rehabilitation. For example, they may want certain features of the site to remain un-decommissioned or un-rehabilitated (e.g. laydown areas or access tracks).
- Development of rehabilitation targets.
- Approach to dismantling and removing temporary structures (for example work camps, workshops etc.).
- Consideration of erosion and sedimentation control including establishment of controlled drainage to allow the site to stabilise passively.

- Removal of waste and management and disposal.
- Details of environmental controls during decommissioning activities such as earthworks (e.g. noise, dust, erosion and sedimentation etc.).
- Decommissioning and rehabilitation work program.
- Establish rehabilitation monitoring requirements against the rehabilitation targets.Audit and assurance program to ensure that the objectives and commitments are met.

This RTP will cover the decommissioning and rehabilitation of integrated operational areas including (but not necessarily limited to): construction laydown areas; workers' camps; haulage roads that are not part of the existing road network (as required); concrete batching plant; borrow pits and quarries (only if to be used for the RTP); areas use for rock crushing; asphalt mixing area.

3.4 Operations and Maintenance

Project financed, performance-based road maintenance activities will be carried out including:

- Pavement maintenance including pavement crack sealing, pothole patching, and surface resealing/ maintenance, line markings etc.
- Roadside maintenance including vegetation control, maintenance of signs etc.
- Cross-drainage structures maintenance – Road surfaces are kept stable2 and culverts and other drainage structures are kept cleared and desludged (such as sedimentation dams and constructed wetlands) on a routine basis and following major impact events such as floods
- Downstream drainage (natural or engineered) and receiving water are inspected on a routine basis or after significant storm activity, focusing on evidence of sedimentation and declining water quality in downstream areas. Where there are significant issues3, actions will be undertaken to contain, control and cleanup. Design work will be undertaken to reduce the risk of repeat events
- The structural integrity of the road and associated infrastructure are monitored and, where erosion, land slips or other forms of land failure are occurring, works will be undertaken to stabilise the assets and the surrounding terrain and controls implemented to stabilise erosive processes from continuing to destabilise the structures and carry out works to rectify failing landscapes. For example, road sealing, gabion baskets, riprap, diversion drains or bio-engineering alternatives will be used to reduce scour and erosion
- Safety, quality and environmental management – including traffic control, work safety, environmental protection and quality control

These activities will be outlined in an Operations Management Plan which will detail operations activities including inspection, monitoring and maintenance as well as incident response and clean-up.

Linked to sub-project performance-based maintenance, the project would support the GoPNG to implement, in close coordination with other development partners, the sector reform agenda embodied in Road Fund and Management Act, 2020, especially for reliable funding for multi-year road maintenance contracts.

[2] Periodic resealing may be required every 5 years to rejuvenate the surface and rehabilitation restore smoothness and durability approximately every 15 years. Different roads in different locations will have different maintenance requirements (Asian Development Bank, 2003). Routine monitoring and inspection of the road surfaces will provide a measured understanding of when the roads need to be rejuvenated and rehabilitated.

[3] Road surfaces will accumulate fine particulates, hydrocarbons, rubber, heavy metals and other toxic substances. During storm events the first flush can carry this surface film into the stormwater drainage system and into downstream environments. Left uncontrolled this can impact water quality and pose toxic impacts on aquatic ecology and human health.

4 Policy, legal and regulatory framework

4.1 GoPNG Requirements

4.1.1 PNG Environmental Legislation

Environmental impact assessment and management in PNG is legislated under the *Environment Act* of 2000 and its accompanying regulatory instruments including the *Environment (Prescribed Activities) Regulation*, 2002, and the *Guideline for Conduct of Environmental Impact Assessment and Preparation of an Environmental Impact Statement*, 2004. The Act and regulations are administered by the CEPA. The *Environment Act* caters for the sustainable management of the biological and physical components of the land, air and water resources of the country. Other related legislation administered by CEPA includes; the *Fauna (Protection and Control) Act* (1966) the *Conservation Areas Act* (1978), the *International (Fauna and Flora) Trade Act* (1978), the *Crocodile Trade (Protection) Act* (1978) and the *National Parks Act* (1984).

The *Environment (Prescribed Activities) Regulation* 2002 categorizes projects as "Prescribed Activities" and breaks them down into three levels (i.e. Level 1, Level 2 or Level 3). These activities are listed in two schedules according to the anticipated potential environmental impact. Schedule 1 consists of Level 2 activities that are subdivided into two categories (Category A and B). Category B has 13 sub-categories with sub-category 12 addressing Infrastructure Development. Item 12.5 includes "Construction of new national roads" which is a Level 2, Category B Prescribed Activity. At the time of preparation, Reconstruct, Repair, Rehabilitation and Maintenance works proposed are not included in the list of "Prescribed Activities".

In addition to "Construction of new national roads" the following prescribed activities may also apply to the RTP:

- 7.4 – quarrying involving the extraction of more than 100,000 tonnes per year;
- 7.5 – Gravel extraction operating continuously for more than 6 months and involving the extraction of more than 10,000 tonnes per year; and
- 13.2 – Discharge of waste into water or onto land in such a way that it results in the waste entering water, except where such discharge is ancillary or incidental to, or associated with, any other activity in this Regulation in which case that category of activity will apply to the discharge of waste.
- Section 5.2.4 Conservation areas describes the Wildlife Management Areas, Conservation Areas, National Parks and Protected Areas or any area declared to be protected under the provisions of an International Treaty to which PNG is a party and which has been ratified by the Parliament of the Independent State of PNG. There are a number of locations along the highways' where nominated areas are within close proximity to the alignment.

Pursuant to Division 2, Section 44 of the *Environment Act*, "…a person commits an offence where he carried out…a Level 2 or Level 3 …activity without an environment permit.

According to Division 2, Section 48 of the *Environment Act*, the Borrower must register the intention to carry out a Level 2 or Level 3 activity with the Director of CEPA at least one month prior to commencing any preparatory work.

Pursuant to Section 50 of the *Environment Act*, for a Level 2 activity, if the Minister determines that the activity relates to matters of national importance, the Director may require the Borrower to undertake an environmental impact assessment. It is unlikely that this would be triggered for this project because with appropriate controls in place, there should be little risk of serious harm to the environment.

For a Level 3 activity, the Director will require the development of an EIA in relation to the activity. As such, if any activity may result in "a significant risk of serious or material environmental harm" within a Wildlife Management Area, Conservation Area, National Park, Protected Area or any area declared under an International Treaty to which PNG is a party, an EIA will need to be conducted in relation to the proposed activities in accordance with Division 3 (Environmental Impact Assessment) and submitted for approval by the Minister.

The following legislative enactments complement the *Environment Act 2000*:

- *Environment (Prescribed Activities) Regulation 2002*. This regulation defines activities that are categorised as Level 2 or Level 3. Schedule 1 of this regulation further divides Level 2 activities into two categories (A and B). Category A activities are considered to have a lower impact than Category B and therefore generally require a lower degree of regulation.
- *Environment (Permits) Regulation 2002*. This Regulation outlines forms issued under the legislation and frames the permit application, renewal, amendment, assessment, referral and appeals process for Level 2 and Level 3 activities.
- *Environment (Water Quality Criteria) Regulation 2002*. This Regulation prescribes water quality criteria for protection of aquatic fauna in fresh and marine waters.
- *Conservation and Environment Protection Authority Act 2014*. The Act also provides for payment of a new 'environment management fee' and additional consequences for an environment permit holder for failure to pay this fee.
- *Environment (Amendment) Act 2014*. This Act introduces supporting and consequential amendments to the Environment Act 2000. It includes increases in maximum fines that may be imposed for breach of certain provisions of the Environment Act 2000 and provides further detail on the classification of Level 2 and Level 3 activities.
- *Environment (Fees and Charges) Regulation 2002*. This Regulation establishes fees applicable to environmental permits and associated activities.

The CEPA advise that while approval of new road construction is part of their responsibility, road and bridge maintenance and monitoring is within DOWHs authority. The Initial Environmental Examination (IEE) will be submitted to the Environment Branch of the DOWH for review and a copy sent to DEC.

The likely environmental assessment and permitting process for the RTP under the PNG *Environment Act 2000* and associated regulations is summarised inFigure 4-1.

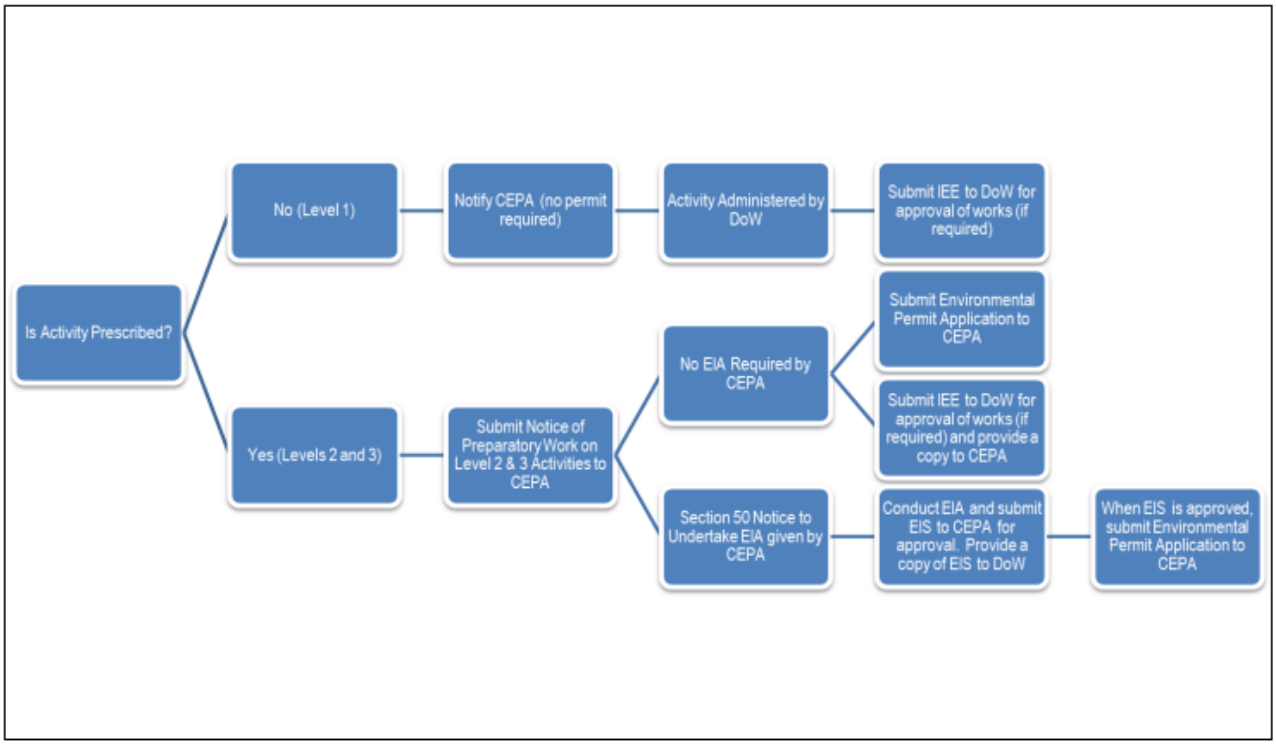

Figure 4-1 PNG environmental assessment and permitting framework

4.1.2 Other Legislation, Guidelines and Codes of Practice

Additional legislation that may be relevant to the project includes:

- *Land Act 1996.* Governs land access for the Project and allows for the acquisition of customary land for public purposes or agree with landholders for land use. It provides a mechanism for compensation. The GoPNG has acquired road reserves for the main national roads.
- *Fauna (Protection and Control) Act 1966*. This Act establishes procedures to declare fauna protected and establish sanctuaries, protected areas and Wildlife Management Areas. It is administered by CEPA.
- *Conservation Areas Act 1978*. This Act provides for the preservation of the environment and of national cultural inheritance by conserving sites and areas with biological, topographical, geological, historic, scientific or social importance, for the management of those sites and areas and for related purposes. Any alteration of land use within conservation areas is controlled under the Act. This Act is administered by CEPA.
- *Employment Act 1978*. Applying to the employment of nationals and non-citizens, this Act covers recruitment, conditions of employment as well as health and safety aspects. It is administered by the Department of Labour and Employment. Conditions of the Act will be relevant to the health and safety of workers employed during Highway upgrade works.
- *National Cultural Property (Preservation) Act 1965*. This Act relates to the preservation and protection of objects of cultural or historical importance to PNG. It is administered by the National Museum and Art Gallery. Should any chance finds be made during completion of Highway upgrade works, this Act will be triggered.
- *Public Health Act 1978*. This Act protects the general public by numerous measures including regulation and control of the unplanned disposal of any environmental contaminants such as domestic or industrial waste and/or refuse that will have some kind of impact on the lives of people. The Act regulates the proper and planned establishment of waste disposal points such as rubbish dumps and landfills so that such establishments are seen to be causing minimal inconvenience to people's lives. The Act also covers the areas of general health, sanitation, cleaning, scavenging and disposal of wastes. It covers all the activities that pose risks and potential risks, and inconveniences by their output to the usage of the environment surrounding the area of activity. As the project will affect the lives of people, especially the local communities within the vicinity of the route, this Act is applicable to this project.
- *Public Health (Drinking Water) Regulation 1984*. This Regulation establishes drinking water quality standards for raw (untreated) water.
- *Organic Law on Provincial and Local-Level Governments 1996*. This legislation provides substantial responsibility for law-making powers relating to conservation and sustainable development to provincial and local-level governments.
- *Industrial Safety, Health and Welfare Act 1961*. This legislation establishes a responsibility for employers to install programs that create awareness about occupational health and safety issues including cleanliness, air emissions and ventilation, working in confined spaces, dangerous work conditions, clothing, chemical hazards and stress.
- *Industrial Safety, Health and Welfare Regulations 1965*. This Regulation establishes standards for lighting, employee amenities, access and first aid facilities within the workplace.

Applicable PNG Government guidelines and codes of practice include the following:

- DOWH Draft Safeguards Policy, 2019
- Dow Draft Safeguards Manual, 2019

- Motor Vehicle and Machinery Workshops, Hydrocarbon Fuel Storage, Re-sale and Usage Sites Code of Practice (1997).
- Environmental Guidelines for Roads and Bridges (1997).
- Environmental Impact Assessment Guidelines for Roads and Bridges (2003) (aka Code of Practice).
- Guideline for submission of an application for an environmental permit to discharge waste (2004).
- Guideline for Conduct of Environmental Impact Assessments and Preparation of Environmental Impact Statement (CEPA, 2004)
- Guideline for Preparation of an Environmental Management Plan (CEPA, 2013)
- Guidelines for submission of an application for an environmental permit to discharge waste (GL-ENV/03.2004) including
    - Noise discharges (IB-ENV/03/2004
    - Air discharges IB-ENV/02/2004
    - Water and land discharges IB-ENV/04/2004.
- Valuer General, Compensation Schedule for Trees and Plants, all Regions, August 2013

4.2 World Bank

The World Bank is committed to sustainable development. The Environmental and Social Framework (ESF) sets out how the World Bank and its partners achieve this commitment. The Framework comprises of:

- A Vision for Sustainable Development, which sets out the Bank's aspirations regarding environmental and social sustainability;
- The World Bank Environmental and Social Policy for Investment Project Financing, which sets out the mandatory requirements that apply to the Bank; and
- The Environmental and Social Standards, together with their Annexes, which set out the mandatory requirements that apply to the Borrower and projects.

The Environmental and Social Standards outline the requirements for Borrowers relating to the identification and assessment of environmental and social risks and impacts associated with projects supported by the Bank through Investment Project Financing. The Bank believes that the application of these standards, by focusing on the identification and management of environmental and social risks, will support Borrowers in their goal to reduce poverty and increase prosperity in a sustainable manner for the benefit of the environment and their citizens.

There are ten Environmental and Social Standards that DOWH needs to meet throughout the life cycle of the RTP. The following Standards are relevant and/or could be triggered by this project:

- *ESS 1: Assessment and Management of Environmental and Social Risks and Impacts*
  Borrowers must conduct environmental and social assessments of their projects for World Bank financing to help ensure that projects are environmentally and socially sound and sustainable. As part of this assessment the Borrower must undertake stakeholder engagement and disclose appropriate information in accordance with ESS10 and develop an Environmental and Social Control Plan (ESCP). The Borrower must also conduct monitoring and reporting on the environmental and social performance of the project against the ESSs. The RTP will finance the rehabilitation of the Ramu and Hirita highways. It is expected that the impacts would be local, reversible and readily managed with proven or standardized mitigation measures. This ESIA provides commitments for managing and mitigating the impacts.
- *ESS2: Labour and Working Conditions*
  The key purpose of this standard is to promote safety and health at work, promote fair treatment, non-

discrimination and equal opportunity of project workers. This includes the protection of vulnerable workers such as women, persons with disabilities, children and migrant workers, contracted workers, community workers and primary supply workers. This standard requires the Borrower to develop and implement written labour management procedures applicable to the project which set out the way in which project workers will be managed to meet these standards ensuring the promotion of safe and healthy work. Elements of this project have been selected to address the requirements of ESS2 including "Search for higher impacts on the corridor by further empowering women" and "Institutional Strengthening, Project Management and Technical Assistance".

- *ESS3: Resource Efficiency and Pollution Prevention and Management*
  The key purpose of ESS3 is to address resource efficiency and pollution prevention and management throughout the life cycle of a project. The Borrower must consider ambient conditions and apply technically and financially feasible resource efficiency and pollution prevention measures in accordance with the mitigation hierarchy. This ESIA includes mitigation measures to reduce the drain on resources (such as energy, water and other raw materials) and prevent and manage pollutants including hazardous and nonhazardous chemicals and wastes and management of pesticides.

- *ESS4: Community Safety and Health*
  ESS4 mandates that Borrowers protect the health, safety and security of project-affected communities, particularly vulnerable people. The Borrower must evaluate the risks and impacts of the project on the health and safety of the affected communities during the project life cycle. ESS4 has a significant focus on traffic and road safety for the workers, affected communities and road users requiring that the impacts be assessed and ensure that impact mitigation is considered in the design. Furthermore, during construction, where work could impact on public roads or other public infrastructure the Borrower must implement safety measures to avoid incidents and injuries to members of the public. Elements of this project have been selected to address road safety including rehabilitation of the Hiritano Highway and Ramu Highway, "Road safety strengthening" program, improving the quality and safety of pedestrians' facilities by implementing targeted traffic safety campaigns and supporting post-disaster recovery through a zero-budget disaster recovery contingency.

- *ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement*
  The purpose of ESS5 is to avoid or minimise involuntary resettlement and to avoid adverse social and economic impacts from land acquisition or restrictions on land use. ESS5 provides a framework for ensuring that options are reviewed before making any hard decision to resettle and to ensure that the process drives outcomes that improve the living conditions of poor or vulnerable persons who are to be physically displaced. A Resettlement Framework has been prepared to o guide the management of potential land acquisition and resettlement impacts associated with the sub-projects.

- *ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources*
  ESS6 involves the protection and conservation of core ecological functions of habitats and the biodiversity that they support. It addresses sustainable management of primary production and harvesting of living natural resources by project-affected parties (including Indigenous Peoples). The standard requires the application of the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity. The environmental and social assessment must consider the direct, indirect and cumulative project-related impacts on habitats and the biodiversity they support. The assessment must consider the threats to biodiversity such as habitat loss, degradation and fragmentation, invasive alien species, overexploitation, hydrological changes, nutrient loading, pollution and incidental take, as well as projected climate change impacts. The Borrower must avoid adverse impacts on biodiversity and habitats. When this isn't possible the Borrower must implement measures to minimise adverse impacts and restore biodiversity in accordance with the mitigation hierarchy. The RTP will involve a number of activities relevant to this standard, namely that one of the objectives of the RTP is to update the engineering of the highway to manage the impacts of climate change. As such, there is a risk that the new drainage design could result in hydrological changes, nutrient loading and pollution.

- *ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities*
  This standard aims to drive poverty reduction and sustainable development by ensuring that projects

supported by the Bank enhance opportunities for Indigenous Peoples by ensuring that they participate in the project and that the project does not threaten their unique cultural identity and well-being. The standard aims to ensure that the development process fosters full respect for the human rights, dignity, aspirations, identify, culture and natural resource-based livelihoods of Indigenous Peoples. Where impacts cannot be avoided, they must be mitigated and/or compensation must be given to the Indigenous Peoples affected. A key focus of this standard is the provision of Free, Prior and Informed Consent (FPIC) of Indigenous Peoples if a project will have adverse impacts on land and natural resources, cause the relocation of Indigenous Peoples or have significant impacts on their cultural heritage. The Borrower must ensure that there is a grievance mechanism established for the project.

- *ESS8: Cultural Heritage*
  ESS8 aims to protect cultural heritage from adverse impacts of projects and support its preservation and to promote meaningful consultation with stakeholders regarding cultural heritage. The E&S assessment must consider direct, indirect and cumulative project-specific risks and impacts on cultural heritage. Where possible the Borrower must avoid impacts on cultural heritage. Where this is not possible the Borrower must identify and implement measures to address impacts on cultural heritage in accordance with the mitigation hierarchy. The Borrower must identify stakeholders that are relevant for the cultural heritage that is known or likely to be encountered during the project life cycle.

- *ESS10: Stakeholder Engagement and Information Disclosure*
  ESS10 drives open and transparent engagement between the Borrower and project stakeholders. It aims to establish a systematic approach to stakeholder engagement that will help Borrowers identify stakeholders and build and maintain a constructive relationship with them. The standard requires Borrowers to engage with stakeholders throughout the project life cycle commencing engagement as early as possible in the project development process and in a timeframe that enables meaningful consultations with stakeholders on the project design. Borrowers will provide stakeholders with timely, relevant, understandable and accessible information and consult with them in a culturally appropriate manner which is free of manipulation, interference, coercion, discrimination and intimidation. The Borrower must maintain and disclose a documented record of stakeholder engagement including a description of the stakeholders consulted, a summary of the feedback received and a brief explanation of how the feedback was taken into account or the reasons why not.

ESS09 Financial Intermediaries does not apply because funding is to be provided directly from the World Bank to DOWH.

4.3 International Environmental Agreements

Paragraph 26 of World Bank ESS1 requires the borrower to “ensure that the environmental and social assessment takes into account in an appropriate manner all issues relevant to the project including…obligations of the country directly applicable to the project under relevant international treaties and agreements…”

The GoPNG is a signatory to a number of multilateral environmental agreements (MEAs). Preliminary examination of the receiving environment in the vicinity and downstream of the existing highway indicates the following agreements may be relevant to this project:

- International Plant Protection Convention 1951.
- Plant Protection Agreement for the South East Asia and Pacific Region 1956.
- International Convention for the Prevention of Pollution of the Sea by Oil, London 1954.
- International Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter, London, Mexico City, Moscow 1972.
- United Nations Convention on the Law of the Sea, Montego Bay 1982. International Convention for the Protection of the Natural Resources and Environment of the South Pacific, 1986 (SPREP Convention).

- International Convention on Civil Liability for Oil Pollution Damage, Brussels 1969.
- Convention Concerning the Protection of World Cultural and Natural Heritage 1972.
- Convention on the Conservation of Migratory Species of Wild Fauna and Flora 1973.
- International Convention on the Conservation of Nature in the South Pacific 1976.
- International Convention on Biological Diversity 1992.
- United Nations Framework Convention on Climate Change 1992.
- Kyoto Protocol to the UN Framework Convention on Climate Change 2002.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 1973.
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979.
- RAMSAR Convention on Wetlands of International Importance Especially as Waterfowl Habitat 1971.
- Asia-Pacific Partnership on Clean Development and Climate 2005.
- International Convention on the Prohibition of Military or any other Hostile Use of Environmental Modification Techniques, New York 1976.

Further studies proposed during the Design Phase of the project, particularly baseline studies in the vicinity of proposed works where new sections of the road are required or new drainage structures are needed, will assist to clarify the relevance of the above multilateral environmental agreements.

5 Baseline E&S context

5.1 Physical Environment

5.1.1 Topography, geology and soils

PNG's rugged mountains, complex geology and substantial mineral resources all result from its location along the collision zone between the continental crust of the Australian Plate to the south and oceanic crust of the Pacific Plate to the north. At present, the oblique convergence of up to 11 centimetres per annum between the northward motion of the Australian Plate and northwest motion of the Pacific Plate is absorbed by deformation of a wide zone that incorporates several microplates, including the South Bismarck Plate and the New Guinea Highlands Plate. These plate motions can only be applied to the past five million years and the geological history beyond this time is difficult to reconstruct (MBS Environmental, 2015).

Many aspects of the nation's geology and tectonic evolution remain poorly understood. This is partly a function of the extensive rainforest cover, rugged terrain and limited infrastructure, as well as general lack of studies and published scientific data (MRA 2012). The majority of publications consist of journal papers that deal with specific aspects of the geology or very small study areas. Despite this, there is a general consensus that most deformation and uplift in PNG began in the latest Miocene or the Pliocene (<8 Ma). The present-day rugged topography is therefore considered a very young feature of the country (MBS Environmental, 2015).

In the subsections that follow a high-level overview of the existing conditions of topography, geology and soils is provided. A greater level of detail will be required for Detailed Design work, particularly with regards to soils, topography and land slipping potential will be required (further details are provided in *Section 1.5.3 Final ESIA*). The project is proposing to carry out Scala/DCP testing, trial pits and core drilling to supplement this information (refer to Section 3.2).Ramu Highway

There are three sections on the Ramu Highway that are the subject of the RTP. They are:

- Ramu Coastal area (between Madang and Tapo Ford);
- Range area (Tapo Ford to Usino Junction); and
- Ramu Valley area (between Usino Junction to Waterais Junction).

5.1.1.1.1 Ramu Coastal area (between Madang and Tapo Ford)

The Coastal Section of the Highway traverses a low lying alluvial coastal plain that has subsequently been raised by a few metres above the present flood plains. The alignment varies between 12 and 30m above sea level and has gentle to moderate gradients.

The coastal plan is deeply intended by river mouths and bays and the rivers near the coast often undergo extensive meandering within extensive, swampy floodplains. The seaward margin of this section includes uplifted coral reefs and sand beaches closer to the shoreline (MBS Environmental, 2015).

The Geology is comprised predominantly of alluvium, minor reef corals and marine sands. The northern most portion of the Highway traverses sections of subhorizontal soft marl, siltstone, sandstone and minor conglomerate of Pliocene and Pleistocene age.

Soils on the coastal plain typically comprise alluvial black clays around 1m deep with a dark grey to grey very plastic and sticky heavy clay subsoil overlain by 20 to 60 cm of black to very dark grey very firm to plastic heavy grey topsoil. The organic matter content in the topsoil ranges from low to moderately high (MBS Environmental, 2015).

5.1.1.1.2 Range area (Tapo Ford to Usino Junction)

The Range area is mountainous with closely dissected branching ridges on softer rocks and higher continuous hogback ridges on standstone and limestone fault blocks. It is defined by steep hill slopes, frequent landslide scars and close branching patterns of narrow valleys with small floodplains. The Highway alignment then traverses the northern end of the range where the topography is lower and less extreme and follows the base of valleys as far as practicable. Elevations typically vary between 26 m and 520 m above sea level, although surrounding mountain peaks may reach as high as 1,160 m above sea level with an average slope through the entire section being approximately 5 percent, with a maximum of over 20 percent.

The majority of soils encountered within the range are well drained and may have inclusions of rock fragments within their profiles. Due to elevated rainfall in the range, soils situated on soft rocks with critical slope angles are prone to frequent naturally occurring landslides. The frequency of landslides is significantly increased where ground disturbance has occurred (e.g. road construction) and the existing Highway exhibits significant areas of subsidence, creep and slips (MBS Environmental, 2015).

5.1.1.1.3 Ramu Valley area (between Usino Junction to Waterais Junction)

The Ramu Valley is located between two steep mountain ranges, notably the Finisterre Range to the northeast and the Bismarck Range to the southwest. A prominent northwest faulted wide level grassland valley extends from the Markham Valley located to the southeast.

Two land systems occur along the Inland Valley Section. The majority of the Highway occurs on very gently sloping to undulating alluvial plain between the Ramu River and the Finisterre Range. Physical features typical of this land system comprise little-dissected coalescent fans up to several kilometres long, sloping up to 2º from the backing hills. The second land system encountered along the Inland Valley Section comprises the strongly dissected steep foothills along the southern flanks of the Finisterre Range.

The elevation gradually increases along the Inland Valley Section of the Highway between Usino Junction (160 m) and Watarais (450 m). The average slope along the existing Highway alignment is approximately 1.4 percent, with a maximum slope of 10 percent. In the Ramu valley, streams entering the northern side of the valley frequently wash out bridges during heavy rains (MBS Environmental, 2015).

The soils of the Ramu valley are young and mainly consist of sandy loams and well drained. Depending on their location many of the soils are shallow and overlie deep deposits of alluvially washed gravels and boulders. The soils are prone to erosion so removal of vegetation in this area could pose high risk of erosion (MBS Environmental, 2015).

5.1.1.2 Hiritoma Highway

The highway alignment between the Brown River and Laloki River mainly traverses lowland country comprising low coastal fringing swamps with occluded drainage. The swamps have developed on the floodplains of the major rivers that drain to the south coast from the Owen Stanley Mountain Range. Interspersing the swampy areas of the Brown River are low rolling hills that risk to about 100m (ADB, 2011).

The floodplain and swamps have built up from Pleistocene littoral sediments derived from the upstream areas. The surrounding low foothills are situated on Port Moresby beds that are composed of siliceous argillite, shale, calcilutite, minor chert and calcarenite of the late to middle Eocene (ADB, 2011).

The soils that have developed on the floodplain are young and mainly consist of silty loams with limited clay development. These soils are poorly drained, are persistently wet and are high in organic matter (ADB, 2011).

Earthquakes are uncommon in this area (ADB, 2011).

A greater level of detail will be required for Detailed Design work, particularly with regards to soils, topography and land slipping potential, will be required. The project is proposing to carry out Scala/DCP testing, trial pits and core drilling to supplement this information (refer to Section 3.2).

5.1.2 Climate

PNG has a hot, humid tropical climate which is experienced all year round. The country experiences two distinctive seasons: wet (December – March) and dry (June – September). The average monthly rainfall ranges between 250 – 350 mm and average temperature is between 26 - 28°C (World Bank Group, 2021). The coastal plains have an average temperature of 32°C, the inland and mountain areas average 26°C, and the higher mountain regions, 18°C (Climate Change and Development Authority Papua New Guinea, 2018). Humidity is relatively high, ranging between 70 – 90 percent. PNG is home to one of the wettest climates in the world and annual rainfall in many areas of the country exceeds 2,500 mm, with the heaviest events occurring in the highlands.

PNG is exposed to climate variation and has regularly experienced extreme weather conditions including; cyclones, landslides, flooding and droughts related to El Nino conditions. Climate models show that by 2050 temperature may increase by 1.2-1.3°C; rainfall may increase by 2.2 percent to 8.8 percent, droughts and floods will be more intense and sea level may increase by between 20-40cm (ADB, 2011). PNG is experiencing increasing rainfall. The highlands, in particular, where annual average rainfall can reach 8,000mm, have a long history of severe floods. Despite large uncertainty surrounding rainfall projections in the Pacific, future El Niño-related events are likely to drive many of the changes in rainfall. Year to year variability in climate is strongly influenced by the El Niño conditions in the southeast Pacific, which bring drought conditions to PNG, especially in the drier areas of the country, in the Southern and Mainland and the Northern Region. Furthermore, the effects of sea-level rise are already apparent, and likely to result in inundation of coastal wetlands, coral bleaching, loss of wetlands, and eventually may displace communities with consequences for social cohesion. (The World Bank, 2021).

The future climate of PNG is projected to change. According to CSIRO there is a high confidence that over the course of the 21st century:

- The surface air temperature and sea-surface temperature are projected to continue to increase;
- Annual and seasonal mean rainfall is projected to increase;
- The intensity and frequency of days of extreme heat are projected to increase;
- The intensity and frequency of days of extreme rainfall are projected to increase;
- Ocean acidification is projected to continue; and
- Mean sea-level rise is projected to continue (Climate Change and Development Authority Papua New Guinea, 2018).

5.1.2.1 Ramu Highway

The Ramu Highway is situated in a wet humid tropical climate. Mean annual rainfall varies from 1872 mm at Gusap in the upper Ramu valley to 3,594mm at Madang. The wet season is uniform throughout the area and occurs between November and April followed by a dry season from May to October. The lower rainfall in the Ramu valley results from the general alignment of the valley with the south-westerly winds and the lack of any orographic features within the valley while the presence of higher mountains on either side of the valley with their associated orographic effect results in a high rainfall gradient between the centre of the Ramu valley and the surrounding mountains (MBS Environmental, 2015). Rainfall for two stations in the Ramu Valley and Madang is shown in Table 5-1

The area can experience heavy rainfall and occasional intense tropical storms during the wet season. Unexpected flash floods can be experienced in the Ramu Valley resulting from heavy rainfalls occurring in the upper Finisterre Ranges while the Ramu valley has received no rain (ADB, 2011).

Temperatures are reasonably uniform throughout the year and are slightly higher inland. Seasonal and diurnal temperatures range from 18 to 33°C (ADB, 2011).

Table 5-1 Madang climate data

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C	25.9 °C	25.7 °C	25.6 °C	25.4 °C	25.5 °C	25.4 °C	25.1 °C	25.1 °C	25.3 °C	25.5 °C	25.6 °C	25.7 °C
Min. Temperature °C	24 °C	23.8 °C	23.7 °C	23.6 °C	23.6 °C	23.5 °C	23.3 °C	23.2 °C	23.3 °C	23.5 °C	23.6 °C	23.9 °C
Max. Temperature °C	29.3 °C	29.2 °C	28.8 °C	28.5 °C	28.3 °C	28.2 °C	27.8 °C	28.1 °C	28.4 °C	28.6 °C	28.7 °C	29 °C
Precipitation / Rainfall mm	432	404	475	422	262	156	180	157	158	234	344	441
Humidity (percent)	89 percent	89 percent	90 percent	91 percent	90 percent	89 percent	89 percent	88 percent	88 percent	88 percent	90 percent	90 percent
Rainy days (d)	20	19	20	20	18	16	15	14	14	16	19	21
avg. Sun hours (hours)	8.5	8.2	8.0	7.6	7.7	8.1	8.2	8.4	8.5	8.6	8.1	8.1

Source: climate-data.org.

5.1.2.2 Hiritano Highway

Climate is subhumid tropical in the floodplain area which grades to wet tropics with increasing elevation towards the Owen Stanley Ranges. Rainfall is derived from the north-west monsoon, between December and March, whereas the stronger south-easterly trade winds between May and October bring cooler drier weather. As the NW monsoon trend parallel to the direction of the Owen Stanley Ranges these produce comparatively lower rainfall at the lower elevations which has led to the development of the coastal strip of savannah woodland vegetation. As rainfall increases with elevation, the savannah merges to rainforest at higher elevations. Annual rainfall for Port Moresby is 1,163 mm, increasing to 2,530mm at the Sogeri plateau situated above Port Moresby in the lower Owen Stanley Ranges. The area can experience heavy rainfall and occasional intense tropical storms during the wet season. Climate data is shown in Table 5-2. Seasonal and diurnal temperatures range from 18 to 33°C.

Table 5-2 Climate data Port Moresby W O: Latitude: 09.45 South Longitude: 147.20 East, Elevation: 42m

Parameter	unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Av monthly Rainfall	mm	187.6	191	209.5	134.7	70.8	48.5	23.8	25	31.2	32.9	75.4	132.3	1162.7
Max monthly rainfall	mm	465	434	498.4	364	403.6	456.2	111.8	134.8	344	129.4	433.2	291.4	498.4
Max daily rainfall	mm	188.2	158.6	185.8	327.4	305.4	204.8	100.2	105.8	47	109.4	163.2	143.4	327.4
	Date	18.01.05	18.02.03	07.03.85	12.04.46	11.05.94	5.06.63	28.07.96	05.08.82	16.09.07	29.10.89	13.11.07	18.12.96	
Min monthly rainfall	mm	26.0	60.0	28.0	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0
Mean Sunshine	hrs	168.9	137.8	158.2	183.4	194.5	170.8	193.4	193.3	181.1	219.8	198.8	227.7	2227.7
Mean Max Temp	°C	32.1	32.0	31.5	31.4	30.9	30.5	29.9	30.1	31.0	32.1	32.2	32.7	31.4
Mean Min Temp	°C	24.0	24.0	23.8	23.8	23.8	24.0	22.6	22.8	23.5	23.7	24.2	24.2	23.7
Mean R.Humidity	%	73	73	74	74	73	73	69	67	68	65	67	67	70

Source: PNG Weather Office
Rainfall 1945-2010; all other variables from 2000-2010.

The average rainfall varies from 1,300mm on the south coast near Kerema to over 5,000mm in the upper Kikori Valley Malalaua-Kerema Road in the Gulf Province (GoPNG and World Bank, 2011).

5.1.3 Water resources

Surface runoff is generated during the wet season. Existing condition of the highways results in excessive erosion and washouts when rainfall washes across the currently unpaved surfaces.

The Final ESIA will outline downstream water and groundwater users located along the Ramu and Hiritano Highways ensuring that they are considered in detailed design. This will require consultation work with the key stakeholders (such as the Department of Health, CEPA, Department of National Planning and Rural Development, local community representatives) to identify water users, how the water is used and to understand the impacts of the project on these water sources.

5.1.3.1 Ramu Highway

The Coastal Section traverses two relatively flat catchments; the larger Gogol catchment and the smaller Gum catchment. The Gogol catchment drains approximately 2,165 kilometres^2 into the Gogol River, which discharges to Astrolabe Bay. The river has undergone significant meandering, particularly in proximity to the coast and its waters contain elevated sediment loads. The Gum catchment covers approximately 172 kilometres^2 and drains into the Gum River, which also discharges to Astrolabe Bay.

The drainage system of the Finisterre Ranges is a complex pattern of dendritic water courses that arise within the steep rugged terrain. The southern side of the Finisterre Range drains to the Ramu River while the northern side drains to the coast. All of the watercourses have very steep gradients that change to moderate gradients as the channels emerge from areas of steep terrain. The channels are actively down cutting and are located in the base of "V" shaped valleys with limited channel sideways movement. Undercutting of the slopes which are composed of soft rocks makes the area prone to landslides. Where the channels emerge from the steep sided valleys the river gradient decreases, and bed load accumulates in the lower valleys. Here the rivers flow over the accumulated deposits and become slightly braided with pronounced meander patterns limited by the narrow width of these valleys (ADB, 2011).

The water resources of the Ramu valley are derived from fast flowing rivers and streams that drain from the Finisterre and Bismarck Ranges. Drainage in the valley is separated at Watarais with the Markham Valley draining to Lae and the Ramu Valley draining to the north coast. The rivers have built up extensive alluvial fan deposits of loose materials where they are deposited onto the Ramu valley floor (ADB, 2011). Many of the valley watercourses have incised vertically through these highly erodible deposits, with relatively straight sided channels often exceeding 4 m in depth (MBS Environmental, 2015).

Based on anecdotal evidence, the highest flows are normally recorded from December through to March during the north-western monsoon derived wet season, though intense thunderstorms which occur regularly within the valley outside the wet season. It produces unseasonably fast flash floods which can erode the bottom of channels making previously stable river crossings unexpectedly hazardous. Low flows occur from May to June during the dry season (south-eastern monsoon) (ADB, 2011).

Key named rivers crossed by the Ramu Highway include:

- Ramu River;
- Nuru River; and
- Gogol River.

Within the Ramu Valley, groundwater bores have been installed to supply the Ramu Sugar Estate. These bores have been installed in a confined aquifer occurring within a series of water-bearing sand, gravel and clay beds, overlain by clay and sandy clays. Groundwater is also utilised to provide domestic water in some urban and rural sites along the Highway. The extent of groundwater utilisation, in comparison to surface water, has not been assessed and there is limited to no publicly available information on groundwater quality (MBS Environmental, 2015). In terms of groundwater supply, good groundwater resources are available in the highly porous alluvial fan and valley floor deposits in the Ramu Valley (ADB, 2011).

As stated above in *Section 5.1.3 Water resources* further investigations should focus on downstream and groundwater users, downstream of areas where significant Reconstruction works are to take place (e.g. Naru River) and anywhere works are potentially going to impact downstream water catchments during Detailed Design Phase.

5.1.3.2 Hiritano Highway

The work on the Hiritano Highway will be undertaken between two major rivers, the Laloki to the south and the Brown River to the north. The Brown River is a tributary of the Laloki River. The Laloki and Brown Rivers rise and fall with the season, usually flooding from January to April where the water fans out over the floodplain forming vast

swampy areas. The rivers along the Hiritano Highway are turbid and carry high loads of suspended sediments and some bed load which consists of large gravel and stone. The Laloki and Brown River alignments are reasonably stable.

No water quality measurements are available for the rivers but are expected to be reasonable in terms of low nutrient inflow from the simple agricultural systems which are practiced that do not use inorganic fertiliser inputs. Health water quality parameters such as bacterial counts would be expected to be unsatisfactory in the Laloki River due to upstream settlement and to a lesser extent in the Brown River which lower density settlements in the upper catchments.

The extensive floodplains with coarse deposits will have excellent groundwater resources close to the surface.

As stated above in *Section 5.1.3 Water resources* further investigations should focus on downstream and groundwater users downstream of areas where significant Reconstruction is to take place during Detailed Design Phase. Impacts are anticipated to be less significant along the Hiritano Highway because the areas are low lying and it is unlikely that works will extend beyond the road easement. However, where this is the case the area should be investigated.

5.1.4 Noise

No noise data are available along the existing highway alignments. However, as there are no significant industries within close proximity to the two highways, it is expected that baseline noise levels are low, other than for noise generated within local communities (e.g. people, stock, portable generators etc.) (MBS Environmental, 2015).

It is anticipated that night-time noise levels along the highways will be very low. Overall noise levels are likely to be low. Much of the highways passes through rural areas and wilderness. It is anticipated that noise is likely to reflect this and there is unlikely to be very few areas where human activity will be audible (MBS Environmental, 2015).

The existing condition of roadways may cause excessive levels of traffic noise when vehicles pass because of their unfavourable surface quality (i.e. unsealed sections, potholes etc.) (MBS Environmental, 2015).

5.1.5 Air quality

No air quality measurements are available for the area and, apart from highly localised areas of smoke from village cooking fires, air quality in rural areas will be good (ADB, 2011).

Existing conditions generate airborne dust during periods of high wind and when vehicles pass. However, given the vehicular traffic is moderate, dust levels are likely to be low.

In addition, the Ramu Agri-industries infrastructure such as the co-generation plant would contribute to airborne particulates (MBS Environmental, 2015).

5.1.6 Waste

GoPNG has no solid waste management strategy or regulation or law to manage waste in the country. Waste management is regulated under the are the *Public Health Act, 1973* which manages medical waste and the *Environment Act, 2000* which manages hazardous waste. As such, there are often deficiencies in waste management practices. There are legal provisions that prohibit illegal dumping, including the imposition of fines. Despite this, illegal dumping and burning of waste are common due to the lack of public awareness and education, adequate waste collection services in certain areas and insufficient funding for adequate enforcement; and the relatively low level of fines imposed. The existing regulatory framework lacks a single legislative document to provide for effective planning, management, and operation of the solid waste management sector (Asian Development Bank, 2014).

The government does not implement formal waste reduction or recycling programs however, in some of the major centres (like Port Moresby) there are some commercial recyclers. Informal, household, and community recycling is also practiced, including the use of food waste as animal feed; and reuse of materials of perceived value, such as plastics (Asian Development Bank, 2014).

Due diligence regarding existing waste management facilities that would potentially service the project will be undertaken during early project implementation and summarised in the Final ESIA.

5.2 Biological environment

PNG is an island with high species biodiversity and belongs to the Indonesia-Malaysia region though it also shares similarities to northern Australia. Approximately 60 percent of the land area is covered with dense rain forest containing a wide diversity of flora and fauna, including 650 species of birds and 100 species of mammals. The country has one of the largest remaining tropical forest areas in the world and is classified as one of 18 megadiverse regions. The rainforests are therefore of global and national significance (MBS Environmental, 2015).

PNG has 39 Centres of Plant Diversity and Endemism as defined by the WWF and IUCN and includes 12 of the globally important Endemic Bird Areas recognised by Birdlife International (ADB, 2011).

Plant diversity is particularly concentrated with an estimated 15,000 to 21,000 higher plants and at least 2,000 pteridophytes and more than 3,000 species of orchids. Plant endemism is high at 10,500 to 16,000 species (ADB, 2011).

PNG's mammal diversity includes 242 species of which 57 species are endemic. Introduced species include deer, pigs, dogs and cats. Placental mammals include rodents and bats of which there are 92 species and 32 are endemic. Marsupial diversity is second only to Australia. Bird diversity is particularly high with 762 species of which 85 species are endemic. Reptiles include 305 species with at least 93 snakes, 190 lizards, 14 turtles and two crocodiles. Amphibians include 200 species of which 134 are endemic. PNG has 329 freshwater fish species (excluding the Bismarck Archipelago) of which 149 are endemic (ADB, 2011).

The greatest threat to PNG's natural resources at present is rapid population growth. The country has a population of 5.1 million according to the 2000 PNG National Census and approximately 80 percent of this population (4 million people) live a traditional rural subsistence lifestyle that is supported by the biological richness and diversity of the forests, inland waters and coastal areas. In recent years, the country's rapid population growth (average annual growth rate of 3.5 percent) has imposed greater demands on existing natural resources and now threatens their sustainable use (MBS Environmental, 2015).

5.2.1 Flora

PNG flora has not been adequately inventoried or studied, which makes assessment of proposed developments particularly difficult. Detailed flora surveys will be required prior to Detailed Design in order to adequately characterise the project area. In the absence of such surveys, a broad vegetation description is provided below for each of the Highway sections.

5.2.1.1 Hiritano

The lower sections of the Laloki and Brown Rivers are situated in hilly areas supporting savannah woodland vegetation that consists of open *Themada australis* and *Imperata cylindrica* grassland dominated by two species of scattered Eucalyptus trees probably *Eucalyptus alba* and *Eucalyptus urophylla* with inclusions of scattered cycads. These areas have developed from frequent burning and in the upper hill slopes, some areas of stunted evergreen forest species remain within the valley floors where these have been protected from burning (ADB, 2011).

Savannah woodland areas are found on the floodplains within the lower lying areas along the route alignment. The roads are fringed by leguminous vines and woody weeds. Riparian vegetation alongside the watercourses are typically dominating by *Pit* and rain trees and in poorly drained areas, Sago (*Metroxylon sagu*) occurs (ADB, 2011).

5.2.1.2 Ramu

Vegetation along the Coastal Section of the Highway is heavily disturbed due to logging and agricultural practices. Much of the vegetation is dominated by introduced and native crop species as well as other weed species. Native vegetation appears varied, ranging from tall Saccharum grasslands (*Saccharum spontaneum*) to dense alluvial flood-

plain forest comprised of tall palms up to 30 m high of the genera *Gulubia*, *Orania* and *Ptychococcus* (MBS Environmental, 2015).

Much of the environment along the Range Section of the Highway is heavily disturbed with introduced and cultivated native crop species and other cosmopolitan weeds dominating the flora. Native vegetation within the area typically comprises tropical wet evergreen forest (hill type) with a large percentage of tropical montane evergreen forest and a small amount of limestone forest (MBS Environmental, 2015).

The majority of the Range Section is expected to comprise low-canopy, closed lowland hill forest. This contains more of an open shrub layer, fewer palms and a denser herbaceous layer than found in lower-elevation alluvial forests. The dominant canopy trees are likely to include species of *Pometia, Canarium, Anisoptera, Cryptocarya, Terminalia, Syzygium, Ficus, Celtis, Dysoxylum, Buchanania, Koompassia, Dillenia, Eucalyptus, Vatica, and Hopea*. Dense stands of *Araucaria*, the tallest tropical trees in the world, are also present in scattered locations (MBS Environmental, 2015).

Montane dominant vegetation is expected at higher elevations, particularly on peaks that are situated above the Highway. Predominant canopy species in these areas may include *Nothofagus, Lauraceae, Cunoniaceae, Elaeocarpaceae, Lithocarpus, Castanopsis, Syzygium, Ilex*, as well as southern conifers at higher elevations (MBS Environmental, 2015).

The environment along the Inland Valley Section of the Highway has been extensively altered for agricultural purposes, notably the production of sugar and oil palms and pasture for cattle. Vegetation along this section typically comprises a range of both tall and short grasses, including kangaroo grass (*Themeda australis*), kunai (*Imperata cylcindrica*), *Sorghum nitidum* and the tall cane grass *Saccaharum robusta*. Other vegetation within the dominant grassland includes bamboo, palms, coconuts and various introduced species (MBS Environmental, 2015).

5.2.2 Freshwater aquatic system

There is no information available on aquatic fauna species within the project area and the overall knowledge at a national level is limited. Most studies have focussed on freshwater fish and aquaculture, given the importance these species represent as a food source (MBS Environmental, 2015). PNG has approximately 330 species of freshwater fish, including a few introduced species. Many of the native species share similarities with Australian fish fauna reflecting the close proximity and past links between these land masses. About 10 percent of the freshwater fish species found in PNG also occur in Australia. Approximately two thirds of the PNG native fish species spend their entire lives in freshwater and one third are thought to have an estuarine or seawater stage in their lifecycle (ADB, 2011).

The rivers are turbid all year and, in all rivers, the aquatic habitats consist of both channel and adjoining swamps. Aquatic species include; catfish, Tilapia, eels while freshwater prawns are also found in the channel. Fishing is an opportunistic pastime for the villagers who prefer saltwater fish to the freshwater fish (ADB, 2011).

MBS Environmental (2015) visited three freshwater environments along the Ramu Highway. These are summarised below as well as relevant fauna types:

- **Lowland Rivers**: Turbid waters and silty or muddy bottoms provide poor environments for aquatic vegetation and therefore generally support less aquatic life. These rivers are mostly limited to the Coastal Section of the Highway and are expected to contain species such as catfish, as well as marine species such as croakers (family *Sciaenidae*), silver biddies (family *Gerreidae*), and ponyfishes (family *Leiognathidae*). These rivers are also likely to provide habitat for numerous reptile and amphibian species, including both New Guinea and Saltwater Crocodiles (*Crocodylus novaeguineae* and *Crocodylus porosus*, respectively).

- **Floodplain lakes, swamps, backwaters and other wetlands**: These features are represented by a mosaic of open water, herbaceous swamp, swamp savannah and swamp woodland. They cover large surface areas and contain good quality water that is typically rich in aquatic plants, providing ample food and protection for juvenile aquatic fauna. The majority of such wetlands are typically associated with large rivers and alluvial plains, such as the Ramu River and valley floodplain. Vegetation typically forms a continuous sequence from open water to tall mixed swamp forest, depending on the depth and quality of the water, as well as the

drainage and flooding conditions. Most surface waters within the Ramu Valley can be described by this environment. Fish species may include Catfish (order *Siluriformes*), Rainbowfish (family *Melanotaeniidae*), Gudgeons (family *Cyprinidae*) and Gobies (family *Gobiidae*). Wetland environments are also expected to provide habitat for numerous waterbird, amphibian and reptile species.

- **Upland Tributaries**: These generally comprise clear water flows with steep gradients and an overall lack of aquatic plant species. Such watercourses are common throughout the Range Section of the Highway. Aquatic species may include Eel-tailed Catfish, Rainbow Fish, Hardyheads (*Craterocephalus kailolae*), Grunters, Gudgeons and Gobies.

Rivers, wetlands and their associated aquatic fauna species are being placed under increasing pressure in PNG due to a growing population. Approximately 95 percent of the inland population live within 2 kilometres of freshwater rivers and 70 percent live within 500 m. While most villagers rely on agriculture and hunting for the majority of their food, a proportion of villagers regularly fish in inland waters to supplement their diets. Further impacts occur as a result of various village-based activities, including disposal of domestic and human waste and cleaning of vehicles, clothing and various other items (MBS Environmental, 2015).

During detailed design, downstream freshwater aquatic habitat shall be surveyed and assessed to determine the likelihood of impacts from the RTP. Results will be summarised in the Final ESIA.

5.2.3 Fauna

Terrestrial fauna in proximity of the highways is expected to comprise a disturbed assemblage of hardy species that have lower to moderate cultural and economic value. This is likely to include bats, reptiles including lizards, carpet pythons and death adders, and amphibians including frogs and the introduced cane toad (MBS Environmental, 2015).

The fauna assemblage is expected to increase with increased distance from the highways. Taking the Ruma Highway as an example, MBS (2015) suggested that away from the highway diversity would increase including species such as flying foxes, the cuscus as well as a greater number of bird species including the Sulphur-crested Cockatoo, Palm Cockatoo, Hornbill, Eclectus Parrot, King and Lessor Bird of Paradise, Bowerbird, heron, hawks, crows, starlings, Wood Pigeon and wild ducks – with the latter being actively hunted.

Areas with minimal human disturbance are expected to contain a large diversity of animal species. Fauna surveys within the Madang Province have identified 57 mammal species, 336 bird species, 423 butterfly species and 103 reptile and amphibian species (Nature Conservancy 2013). This biological diversity is considered internationally significant (MBS Environmental, 2015).

Domestic species including cattle, pigs, sheep, goats, poultry and draught animals are also present in communities and agricultural properties along the route (MBS Environmental, 2015).

5.2.3.1 Rare and endangered species

There is limited information available on potentially rare or endangered species in the vicinity of the existing highways. The likelihood of rare or endangered species occurring in the vicinity of the Ramu Highway is considered higher due to the limited existing disturbance (MBS Environmental, 2015).

5.2.3.1.1 Ramu

There is limited information available on potentially rare or endangered species in the vicinity of the existing Highway. The likelihood of rare or endangered species occurring in the vicinity of the RTP is considered higher due to the limited existing disturbance.

The International Union for Conservation of Nature (IUCN) Red List for PNG provides the most up-to-date collated information on rare or endangered species and shows that there could be up to 17 conservation significant mammals and six conservation significant amphibians present within the project area. However, the Red List data for PNG is generally considered limited in accuracy and scope. A summary of Red List species potentially present within the

project area is provided in 0. The International Union for Conservation of Nature (IUCN) Red List for PNG provides the most up-to-date collated information on rare or endangered species and shows that there could be up to 17 conservation significant mammals and six conservation significant amphibians present within the project area however, as noted above they are expected to be more commonly encountered further from the existing road corridor No conservation significant reptiles were identified on the Red List, relevant to the project area, and public access to conservation significant bird species was not available at the time of publication.

Further assessment will need to be undertaken during Detailed Design Phase to determine if there are Red List species habitats that could be disturbed where Reconstruction, Repair and Rehabilitation works are to take place.

5.2.3.1.2 Hiritano Highway

The PNG Keelback Snake (*Tropidonophis statistictus*) is also found in the Hiritano Highway area. The species is normally found between 900 and 2,135 metres above sea level. As such it is unlikely that there would be significant habitat for this species because the stretch of highway passes mainly along the low-lying areas.

5.2.4 Conservation areas

There are two RAMSAR listed wetlands in PNG:

- Bensback and Tonda Wildlife Management Area; and
- Lake Kutubu WMA.

Both are located hundreds of kilometres from the Ramu and Hiritano Highways.

The Ramu Highway passes nearby the following conservation areas:

- The National Balek Wildlife Sanctuary located 10 kilometres south of Madang, near the confluence of the Gogol and Nuru Rivers (see Figure 5-1 Balek Wildlife Sanctuary). The Sanctuary is 5.79 kilometres^2 and is home to many native species. It has a sulphur creek that flows from a large limestone formation. The Sanctuary is protected by Fauna (Protection and Control) Balek Wildlife Sanctuary Rules 1997. The Regulation prohibits the taking and killing of any fauna, the lighting of fires, dispose of refuse or cutting of trees or making of a garden in the Sanctuary.
- The Garim Wildlife Management Area to the east. There is very little information on the Garim WMA.
- The Sepu Banam Wildlife Management Area, Usino Bundi District.
- The Wanang Conservation Area, Usino Bundi District.
- The Foroko Wildlife Management Area, Usino Bundi District.

Key pressures on the Sanctuary include:

- Agricultural cropping;
- Roads; and
- Urban encroachment (European Commission, 2021).

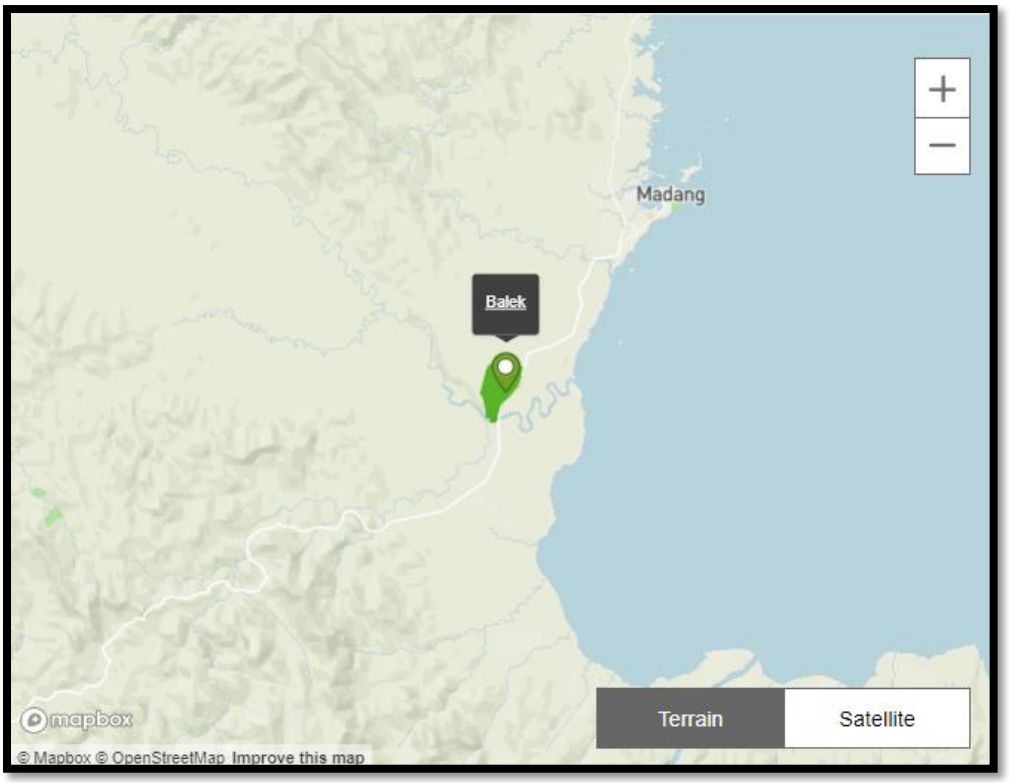

Figure 5-1 Balek Wildlife Sanctuary

The Hiritano Highway has the Iomare Wildlife Management Area (WMA). Iomare is located approximately 20 kilometres north of Port Moresby on the Hiritano Highway, just south of the Brown River. Iomare WMA is 8.27 kilometres².

WMAs are reserved at the request of the landowners for the conservation and controlled utilisation of the wildlife and its habitat. Declaration of a wildlife management area does not in any way affect ownership of the land, only the way in which resources are used. Thus, WMAs represent an attempt to develop conservation on a customary basis, using traditional methods of resource management (Eaton 1986v).

Key pressures on the Iomare include:

- Agricultural cropping;
- Livestock; and
- Urban encroachment.

Since guns were permitted for use in the WMA, animals living in the area have declined. An *Assessment of Management Effectiveness for Papua New Guinea's Protected Areas* concluded that in Iomare the depletion of plant and animal resources has resulted in a decline in deer, birds of paradise, freshwater eels and prawns; timbers including rosewood, pine and kwila. In addition, clean water for people to use has also shown a decline (Conservation and Environment Protection Authority, 2017).

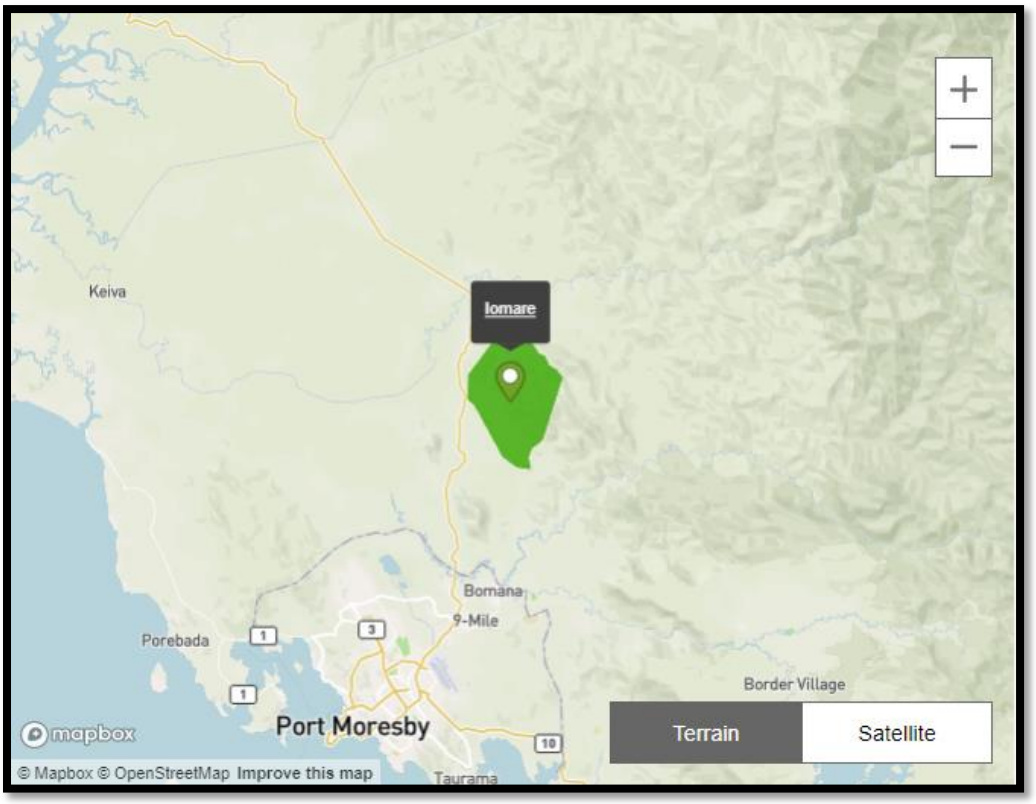

Figure 5-2 Iomare Wildlife Management Area

Other registered areas of conservation significance are located northwest of Usino Junction. These include:

- Sepu Banam WMA (approximately 18 kilometres northwest of Usino Junction).
- Foroko WMA (approximately 44 kilometres northwest of Usino Junction).
- Wanang Conservation Area (approximately 43 kilometres northwest of Usino Junction).

The Wanang Conservation Area represents a 10,000 ha protected lowland rainforest. It contains a field research station and hosts numerous biological research projects and training programs. There is no publicly available information on the Foroko and Sepu Banam WMAs.

Further assessments would be required where road works (such as climbing lanes) and drainage structures would be constructed near conservation areas. Where new clearing required then screening and assessments will be undertaken.

5.2.5 Invasive alien species

Biological impacts from introduced species and invasive species can cause a great deal of damage to naturally adapted systems. Invasive or introduced species are species that are non-indigenous and can colonise and out compete local species. Most of these species are a major threat to freshwater ecosystems of PNG. Aquatic plants such as Salvinia (*Salvinia molesta*) and Water Hyacinth (*Eichhornia crassipes*) have been reported to cause major problems in Sepik River and other major rivers in PNG. Introduced species such as *Tilapia* and Mosquito fish are two examples of pests that threaten natural freshwater fauna in the country. *Tilapia* is the only invasive noted in the area being purposefully introduced about 40-50 years ago. As it provides an ample source of protein it has been particularly well adopted by the local community (ADB, 2011).

In total, over 62 invasive species have been identified in PNG. A summary is provided in **Error! Reference source not found.** and is derived from the IUCN Invasive Species Specialist Group invasive species database. The list is not exhaustive.

Table 5-3 Invasive species identified in PNG (MBS Environmental, 2015)

Invasive species group	No species identified
Trees, shrubs	9
Succulents	1
Aquatic plants/ herbs	6
Vinces/ climbers	5
Herbs	9
Sedges	1
Grasses	2
Mammals	5
Insects	10
Molluscs	3
Fish	8
Birds	1
Reptiles	1
Amphibians	

5.3 Natural Disasters

PNG is subject to a range of natural disasters, including volcanic eruptions, earthquakes, landslides, flooding, and occasional cyclonic activity. Only earthquakes, landslides and flooding are considered relevant to the project area and are detailed in the following subheadings (MBS Environmental, 2015).

5.3.1 Earthquakes

PNG is located in the Pacific Ring of Fire at the collision point of several tectonic plates. This makes PNG one of the most disaster-prone countries in the Pacific region, accounting for 25 percent of all natural disasters between 1950 and 2008. As such, PNG is ranked within the top six countries in Asia-Pacific as having the highest percentage of population exposed to earthquakes (MBS Environmental, 2015).

The project area is located in close proximity to the Ramu-Markham fault line, which runs the entire length of the Ramu Valley. This fault separates the South Bismarck Plate to the north and the New Guinea Highlands Plate to the south and is the cause of significant seismic activity within the region due to a northwards convergence of up to 50 mm per year by the New Guinea Highlands Plate. Assessment of United States Geological Survey (USGS) earthquake data indicates that there have been over 1,000 earthquakes in the local study area since 1973 that exceeded magnitude 4.0 on the Richter Scale. This includes 136 magnitude 5.0 earthquakes, 13 magnitude 6.0 earthquakes and one magnitude 7.0 earthquake. Large, shallow earthquakes in excess of magnitude 7.0 on the Richter Scale occur approximately every 100 to 110 years within the project area while magnitude 6.0 earthquakes have an estimated recurrence interval of approximately 50 to 60 years (MBS Environmental, 2015).

5.3.2 Landslides

The elevated seismicity in combination with steep slopes through the Ramu Range Section, elevated rainfall and structurally weak soils cause frequent landslides. The frequency is worsened where human activity has further destabilised the surrounding soils, such as through the clearing of native vegetation or ground disturbance (e.g. bulk earthworks) (MBS Environmental, 2015).

As stated above in *Section 5.1.1 Topography, geology and soils* field surveys will be needed in areas prone to landslides, where Reconstruction, Repair and Rehabilitation works will be required, impacts assessed and, where required, controls proposed to mitigate the impacts.

5.3.3 Flooding

Flooding is also considered to represent a significant risk throughout the project area and flash floods can occur in valley regions in response to localised heavy rain at altitude. These floods are frequently responsible for closure of the Ramu Highway due to damage or destruction of bridges and roadway. This was highlighted most recently during March 2015 when significant flooding occurred across much of Madang Province and resulted in the destruction of five Highway bridges and the unearthing and movement of a section of the Ramu NiCo slurry pipeline (MBS Environmental, 2015).

Photo 5-1 Ramu NiCo slurry pipeline

Photo 5-2 Ramu NiCo slurry pipeline

5.4 Socio-economic conditions

5.4.1 Communities and culture

In broad terms, the population of PNG is not known with precision. The 2000 National Census gives the total population of PNG as 5.2 million.[4] United Nations estimates the mid-2020 population as 8.947 million[5]. The population is growing rapidly, with growth rate estimates between 2.7-3.1 percent per annum, across recent inter census periods.[6] The mean population density is about 20 people/ kilometres^2. However, there is large variation in population density across the country, with the highest densities found in the most agriculturally productive environments.[7] The majority of people in PNG (approximately 81 percent) live in rural villages, producing much of their own food. Just over 10 percent live in urban areas and the remainder (6 percent) live in rural non-village areas, including rural schools, plantations, mining camps and small missions or government stations.[8]

The culture of PNG is dynamic and complex, with more than 7,000 different cultural groups and over 1000 clans and over 800 languages. The cultural divide by region or area in PNG is traditionally categorised by the Wantok system. At the macro level, wantok is recognised as an identity framework, while at the micro and extended family-level it is a social capital concept, particularly in rural communities. It signifies a context that demands cooperation, caring and reciprocal support and a shared attachment to locality and resources.9 Moreover, it consists of a web of relationships, norms and codes of behaviour, or kastom, that maintain group security and stability. Wantok and kastom are attributes of Melanesian societies that both unite groups of people with a common sense of identity and objectives but also serves to distinguish groups from others.

Initial analysis (refer Figure 5-3 and Figure 5-4) indicates that traditional communities along Ramu highway speak several languages including Rawa, Watiwa, Kesawai, Asas, Sinsauru, Sausi, Urigina, Danaru, Sumau, Girawa, Uyajitaya , Marik, and Amele. On Hiritano between Laloki and Brown rivers, traditional communities speak mountain Kaiali and Toura.

Tok Pisin and Hiri Motu have developed as common languages. Tok Pisin is mostly used as a business language in the Highlands, Momase, and Islands regions while Hiri Motu is a common and effective business language in the Southern region.

[4] Government of PNG (2000) National Report - Census

[5] UN (2020). W*orld population prospects: Papua New Guinea*, United Nations, Department of Economic and Social Affairs, Population Division, UN.

[6] NSO (National Statistical Office) (2013). *Papua New Guinea national population and housing census 2011 census: final figures*, NSO, Papua New Guinea, Port Moresby.

[7] Allen BJ & Bourke RM (2009). People, land and environment. In: Bourke RM & Harwood T (eds), *Food and agriculture in Papua New Guinea*, ANU E Press, Canberra, 27–127.

[8] ibid.

[9] Nanau, G. L. 2011.'The Wantok System as a Socio-economic and Political Network in Melanesia,' OMNES: The Journal of Multicultural Society 2(1): 31-55

Figure 5-3 - Languages - Ramu Highway

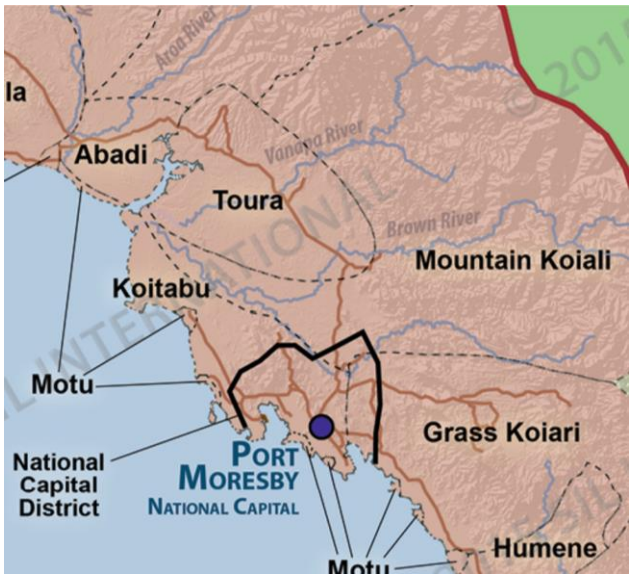

Figure 5-4 - Languages - Hiritano Hwy (Laloki to Brown River)

Source: pnglanguages.sil.org

5.4.1.1 Ramu Highway

Initial analysis outlined below is derived from the *2015 Ramu Highway Social Assessment*, prepared for the Ramu Gateway Joint Venture. Population data provided is sourced from 2011 census data. Current population numbers, settlement, village and clan groups will be confirmed by on-ground survey work.

Ramu Valley - road section 1 and 2

Road section 1, from Watarais Junction to Yokai Bridge (60 kilometres) is characterised by commercial agricultural activity and industry, including oil palm, sugar and cattle. Land areas adjacent to section 1 also include a number of company residential complexes. Initial desktop analysis[10] identifies approximately 17 communities/villages along road section 1, within a 1 kilometre buffer of the road. These communities sit within the wards of Watarais, Wankun, Ramu Sugar Urban, Bumu, Sankain, Ranara, Dumpu (Table 4-3).

Road section 2, from Yokai Bridge to Usino Junction (45 kilometres) is characterised by grassland. Initial desktop analysis identifies approximately 13 communities/villages along road section 2, within a 1 kilometre buffer of the road. These communities sit within the wards of Keswai, Koropa, Sausi, Yakumbu, Walium, Waput and Usino Station (Table 5-4).

The Ramu Valley is more densely populated then other road sections of the Ramu Highway sub-project, particularly through the commercial agricultural areas (road section 1).

Table 5-4 Ward11 Population by District and LLGs (2011 census) – Ramu Valley section

Province	District	Local Level Government	Ward	Total Population	Females
Madang			Watarais	3,666	1,666

[10] Bodhi Alliance (2015), Ramu Highway Social Assessment

[11] For census purposes, PNG is divided into a number of geographical areas. The hierarchical structure begins with the province, followed by the district, local level government, ward and census unit (village).

Province	District	Local Level Government	Ward	Total Population	Females
	Markham District	Umi/Atzera Rural	Wankun	1,629	803
			Ramu Sugar Urban	4,935	2,274
		Naho Rawa Rural	Ranara	834	390
	Unsino Bundi District	Usino Rural	Sankain	1,614	749
			Dumpu	1559	683
			Koropa	1,385	656
			Sausi	1,016	480
			Yakumbu	1,945	930
			Walium	790	388
			Waput	1,252	600
			Usino Station	1,154	543
			Bumu	No data from 2011 Census	
			Keswai	No data from 2011 Census	

Ramu Range – road section 3

The Ramu Range (road section 3) from Usino Junction to Tapo Ford (40 kilometres) is characterised by grassland and forest. The Ramu Range is less populated than other sections of the sub-project. Initial desktop analysis identifies approximately 14 communities along this road section. These communities sit within the wards of Puksak, Naru and Ato (Table 5-5).

Table 5-5 Ward Population by District and LLGs (2011 census) – Ramu Range section

Province	District	Local Level Government	Ward	Total Population	Females
Madang	Unsino Bundi District	Usino Rural	Puksak	963	467
			Naru	1,111	533
	Rai Coast District	Astrolabe Bay Rural	Ato	1,961	936

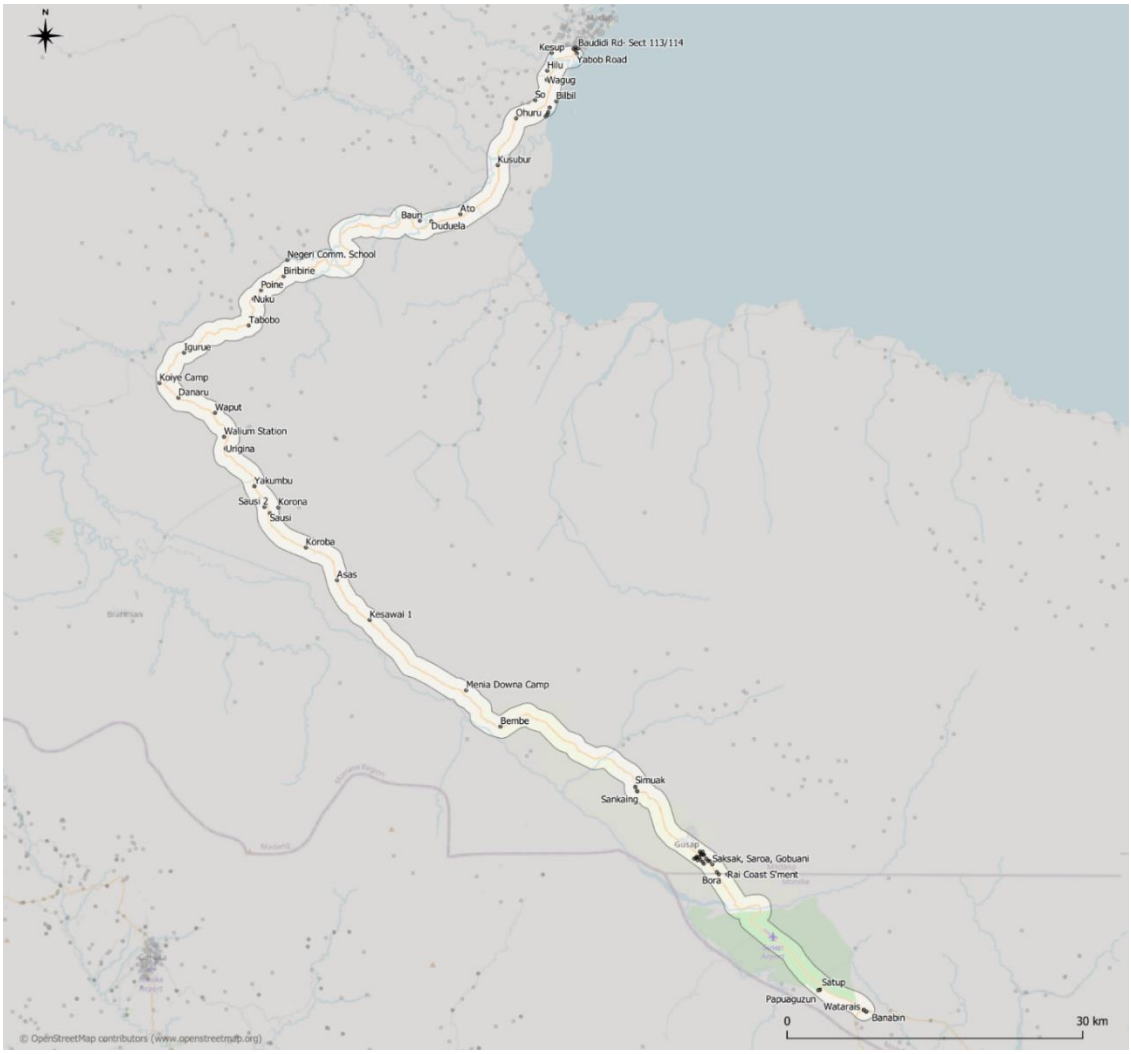

Figure 5-5. Communities along the Ramu Highway (1 kilometre buffer)

Coastal plain- road section 4

The coastal plain (road section 4), from Tapo Ford through the Madang Provincial capital (30 kilometres) is characterised by cultivated land, with limited settlements directly on the Ramu Highway. Initial desktop analysis identifies approximately 3 communities along this road section. These communities sit within the wards of Balima/Kusubar, Sein, and Bahor Sahgala (Table 5-6).

Table 5-6 Ward Population by District and LLGs (2011 census) – Coastal plain section

Province	District	Local Level Government	Ward	Total Population	Females
Madang	Madang District	Ambenob Rural	Balima / Kusubar	1,993	915
			Sein	3,202	1,586
			Bahor Sahgala	4,413	2,037

5.4.1.2 Hiritano Highway

Initial desktop analysis outlined below is derived from the *2014 ADB Bridge Replacement for Improved Rural Access Sector Project Hiritano Highway Resettlement Plan* and aerial imagery from Google Earth. Population data is

sourced from 2011 census data. Population, settlement, village and clan groups will be confirmed by on-ground survey work.

Laloki Bridge to Brown River Bridge

This section of the Hiritano Highway is the first component of main arterial road, heading west from Port Moresby. A number of quarry sites (stockpiles and yards) run adjacent to the Highway, including Nebiri Quarry. Initial desktop analysis identifies approximately 21 communities within a 1 kilometre buffer of the Highway, including a mix of urban settlements and villages, predominantly clustered towards the National Capital District-end of the Highway. These communities sit within the wards of Laloki, Boteka and Brown River (Table 5-7). Initial analysis identifies that Brown River Ward includes settlers from Goilala and Koiari traditional owners. The Laloki bridge site is vacant state land occupied by settlers, mainly from the Koiari, Goilala and Highlands Provinces.[12]

Table 5-7 Ward Population by District and LLGs (2011 census) – Laloki Bridge to Brown River Bridge

Province	District	Local Level Government	Ward	Total Population	Females
Central	Kairuku Hiri District	Hiri Rural	Laloki	3,350	1,518
			Boteka	2,634	1,230
			Brown	2,807	1,251

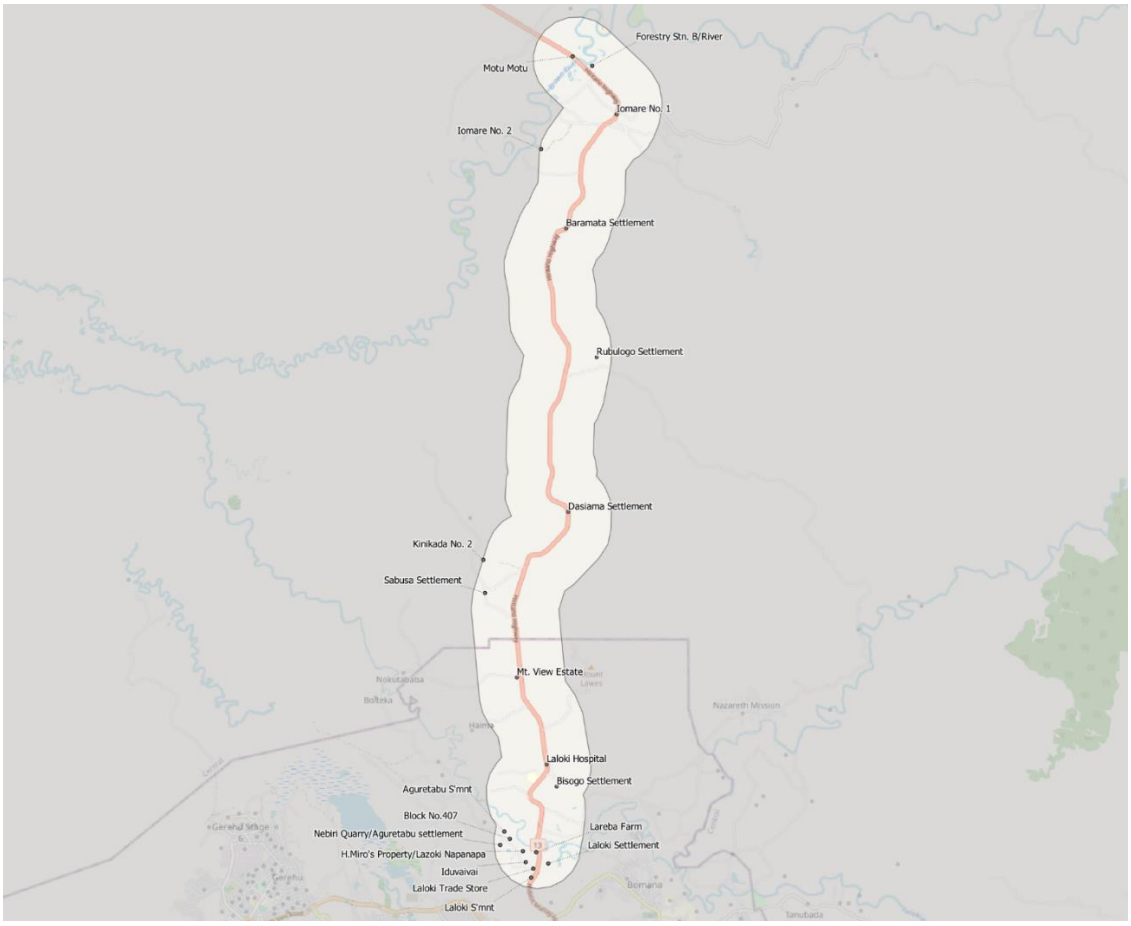

Figure 5-6. Communities along the Hiritano Highway (Laloki to Brown River)

[12] ibid.

5.4.2 Economic Characteristics

5.4.2.1 Ramu Highway – commercial road users

The Ramu Highway is identified as a 'Core Road' in the *2018 DOWH National Road Network Strategy.*[13] Commercial road users of the Ramu Highway include the Ramu Sugar Factory, Ramu Oil Palm and the Ramu Nickel MCC Company. The majority of economic development in Madang Province is concentrated in the Madang and Usino Bundi Districts. Other commercial road users include Madang Fish Cannery, Madang Tuna Processing (Pacific Marine Industrial Zone) and Ramu-Cobalt-Copper, Woodchips Export and Beef Canning, which all make significant contributions to the regional and national economy.

5.4.2.1.1 Agriculture, Logging and Mining

The main cash crops in Madang Province include sugar, copra, coffee, vanilla, palm oil, betel nuts and daka. Both the Markham and Ramu Valleys offer moderate to high land potential with good access to markets. Large scale agriculture comprises palm sugar, palm oil, betel nut, coffee, coconut, beef and other livestock. Ramu Agri-Industries operates out of the Ramu Valley and manages over 8,000 ha for the production of beef, palm sugar, palm oil and ethanol.

The majority of lowland and coastal forests in the Madang Province have been logged or are allocated for industrial logging. Active logging concessions in the Madang Province cover an area of approximately 200,000 ha. A large-scale woodchip and pulp mill has been operating in Madang city for over 30 years and the operator, Jant/Gogol, is one of the largest employers in the Madang Province. In addition to the current logging concessions, the Madang Provincial Government has identified a further 665,000 ha of forest with potential for further logging concessions (RRI 2006). However, no commitment has been made by logging companies to manage these at a sustainable level (FPCDI 2006). The remaining forest resources are located in the currently inaccessible interiors, with road access representing one of the most important constraints on the industry.

There is considerable potential for the mining industry to expand within Madang Province. Currently, there is one operational mine in proximity to the Highway (Ramu NiCo Kurumbukari Nickel-Cobalt Mine (Ramu NiCo). The Kurumbukari Nickel-Cobalt Mine is located approximately 20 kilometres west of Usino Junction and 75 kilometres southwest of Madang. It was commissioned in 2012 and is one of the largest mining projects to have been brought into production in recent years in PNG. The proposed Yandera Mine is located approximately 20 kilometres southwest of the Kurumbukari Nickel-Cobalt Mine. The mine is expected to comprise full open cut mining with onsite processing to produce a copper concentrate.

Utilities and other infrastructure

Utilities and other infrastructure of note along the Ramu Highway include:

- The 132KV Madang to Lae transmission line runs the length of the Ramu Highway, following the existing road alignment.
- The Ramu Nickle slurry pipeline closely follows the road alignment for approximately 35 kilometres in the Ramu Range (road section 3). The pipeline, which transfers lateritic nickel-cobalt slurry from Kurumbukari to Basamuk, is laid partly above ground and crosses under the road in several places. The pipeline has been affected by ground movements in places, resulting in displacement from its supports (Figure 5-7). A pipeline monitoring system and data communication link incorporating pressure sensors strategically placed along the pipeline has been established to alert the mine to any leaks or plugs along the route.

[13] 2018-2037 DoW National Road Network Strategy, accessed from: https://www.works.gov.pg/files/DoW_NRNS.pdf

Figure 5-7 Ramu Nickle Slurry Pipeline

Local economies

Kawavur Market is an informal local produce market, characterised by temporary stall structures constructed on either side of the road. Located along the Ramu Range (road section 3), there is minimal allowance for vehicles to pull off the road and park at the market. There is no infrastructure separating through-traffic from parked vehicles and pedestrians and there is minimal roadside drainage infrastructure (Figure 5-9).

Figure 5-8 Kawavur Market 1

Figure 5-9 Kawavur Market 2

5.4.2.2 Hiritano Highway

The Hiritano Highway is one of PNG's core economic corridors, identified as a 'Core Road' in the *2018 DoW National Road Network Strategy.* Initial desktop analysis identifies users of the Hiritano Highway over the last decade, as

mainly the indigenous people of the Kairuku-Hiri and Goilala Districts of the Central and the Gulf Provinces.[14] The proposed development of the Papua LNG onshore gas project located in the Gulf, approx. 120 kilometres inland from Kerema, also has implications for future increased usage of the Highway.

Local economies

Initial desktop analysis, derived from the *2014 ADB Bridge Replacement for Improved Rural Access Sector Project Hiritano Highway Resettlement Plan,* identify logging companies operating in the area and employing local residents.[15] Sand and Gravel company 'Central Sand and Gravel' has also paid royalties to traditional owners (Koiari) living in the area. Cash income from betel nut sales, coconut, sand and rock sales, roadside vegetable/baking sales also support livelihoods in the area, for both settlers and traditional owners.

5.4.3 Land and Road Corridors

5.4.3.1 Ramu Highway

Initial desktop analysis confirms that 127 kilometres of the existing national road was acquired in 2000, through a European Union-financed project to reconstruct the Ramu Highway[16]. It is unclear what was established as the 'agreed width of road corridor' under that project and this will require confirmation during project design.

More recently, the World Bank, ADB and the Australian government funded- TSSP have worked on various road and bridge rehabilitation and maintenance projects along the Ramu Highway.

Initial imagery assessment indicates that the Ramu Valley section (road section 1 and 2) is a heavily inhabited area, associated with commercial industry (refer Section 4.3.1). The road corridor has been well maintained by DFAT-TSSP financed maintenance works in this section and as such the presence of structures and economic assets is expected to be minor.

The Ramu range section (road section 3) and coastal section (road section 4) are more sparsely populated. It is understood that the Ramu range section has not had any recent rehabilitation works and the road is currently in relatively poor condition. It is likely that a number of structures and economic assets are located within the corridor. Informal market facilities are located in the Ramu range section.

[14] 2014 ADB Bridge Replacement for Improved Rural Access Sector Project Hiritano Highway Resettlement Plan – updated, accessed from: https://www.adb.org/sites/default/files/project-document/160865/43200-024-rp-14.pdf

[16] DFAT (2008) Making land work, Volume II – Case studies Volume two Case studies on customary land and development in the Pacific. Accessed from: https://www.dfat.gov.au/sites/default/files/MLW_VolumeTwo_Intro_Chap.pdf

Photo 5-3 Local roadside market

5.4.3.2 Hiritano Highway

Initial desktop analysis confirms that adjacent sections of the Hiritano Highway (Bereina–Malalau) were compulsorily acquired under the Trans-Island Highway Construction Project, funded by the Government of Japan.[17] The land acquisition process (1993-2000), including identifying landowners and determining compensation extended for the lifetime of the project.

More recently, the ADB have worked on bridge replacement projects in the area, including on Laloki and Brown River Bridges.[18] It is assumed that the that the approaches to the bridges were confirmed under the ADB project. For the remaining length of road between Laloki and Brown River, initial imagery assessment identifies approximately 21 communities within a wider 1 kilometre buffer of the Highway (refer Section 4.3.1), with no assets in the road corridor. This would need to be confirmed on-site (DOWH to confirm –via future land and asset inventory).

5.4.4 Sensitive Receptors (Social)

5.4.4.1 Ramu Highway

Initial desktop analysis identifies markets and at least 1 school (Negeri Community School in the Ramu Range – road section 3) located within a 1 kilometre buffer of the Ramu Highway. Risks for sensitive receptors associated with the upgrading and potential road widening of the Highway (road section 3) include loss of amenity, liveability and temporary disruptions for market operators. Currently the roads are in poor condition and there is noise and dust associated with travelling on the existing road that is impacting travellers and those living in close proximity to the highway.

Considerations of truck stops/pull off bay areas in the vicinity of market areas will need to be reviewed in the design phase, as well as clearly delineated footpaths/traffic calming and shade provision measures in the vicinity of schools.

[17] JICA (2002) Trans-Island Highway Construction Project. Accessed from: www.jica.go.jp/english/our_work/evaluation/oda_loan/post/2003/pdf/2-32_full.pdf

[18] ADB (2014) ADB Bridge Replacement for Improved Rural Access Sector Project Hiritano Highway Resettlement Plan – updated, accessed from: https://www.adb.org/sites/default/files/project-document/160865/43200-024-rp-14.pdf

5.4.4.2 Hiritano Highway

Initial desktop analysis identifies a hospital settlement (Laloki Hospital) located within a 1 kilometre buffer of the Brown River to Laloki River section of the Hiritano Highway (Figure 5-6). Temporary roadside stalls are also likely to operating in the area. As per the Ramu Highway, a risk associated with the upgrading of the Highway include temporary loss of amenity and temporary disruptions for market operators. Considerations of the opportunity to provide footpaths/traffic calming and shade provision measures in the vicinity of the hospital settlement should be considered in the design phase.

5.4.5 Gender and Vulnerable Groups

As the Project develops, identifying individuals and groups who may find it more difficult to participate and those who may be differentially or disproportionately affected by the project because of their marginalised or vulnerable status will be important. Broad identification of vulnerable stakeholders includes: people living outside their customary land/communities (i.e. informal settlers); people with disabilities; vulnerable road users (i.e. children, elderly, road side market vendors and anyone using the road not in a vehicle); women; female-headed households.

5.4.5.1 Gender

Gender inequality is a major issue in PNG as indicated by the country's ranking of 161 out of 189 counties on the UNDP's Gender Inequality Index (189 being the worst) (UNDP 2020b). Women throughout PNG have a high risk of community discrimination due to long-standing traditional values and gender roles that limit their ability to fully participate in a wide range of activities. Key gender and transport issues linked to the poor quality of road infrastructure and services in PNG include limited access to economic opportunity; limited access to health and education services; vulnerability to sexually transmitted diseases and HIV/AIDS.

5.4.5.2 HIV/AIDS

According to UNAIDS, an estimated 45 000 people live with HIV in PNG , with marginalised groups, such as sex workers and others who exchange sex for money, goods and protection, most affected.[19] However, less than half of the people who belong to those vulnerable groups have ever taken a test to know their HIV status. Major roads, like highways represent 'risk' areas, along which there are markets open 24 hours a day, serving as possible 'transaction points.' Initial desktop analysis notes that the Ramu Highway has contributed to an increasing number of men and women from the Highlands coming down to the coast to buy betel nuts sometimes in exchange for marijuana and sex.[20]

[19] UNAIDS 2021, Getting HIV services to marginalized groups in Papua New Guinea, accessed from: https://www.unaids.org/en/keywords/papua-new-guinea

[20] Bodhi Alliance (2015), Ramu Highway Social Assessment

6 Potential environmental and social impacts

Overall, the RTP will be environmentally and socially beneficial by providing improved road infrastructure that is better able to cope with weather events and provides greater levels of service to affected populations. Regional transport infrastructure is essential to support the wellbeing of rural communities by facilitating education and health service delivery, providing opportunities for local economic development through improved access to markets, opportunities for increased agricultural production, onsite processing and increased local employment. Other benefits include improved pedestrian and road safety, greater resilience and effective emergency response, improved amenity and improved erosion and sedimentation control.

The project is unlikely to cause major longer term negative environmental or social impacts as the work is generally not expanding the existing road footprint and sealing sections of the road will significantly reduce existing air quality, noise and safety issues. However, the roadworks through the Ramu Range create specific challenges and risks due to slope stability and by expanding outside the existing road footprint.

The environmental and social impacts have been assessed for the three phases of the project: design; construction; and operations. A full list of risks identified is outlined in Section 7, Table 7-1.

A discussion of the key/priority potential environmental and social impacts is presented below.

6.1 Design Phase

The potential environmental and social impacts during the Design phase will largely be small in nature, short-term and reversible, however planning considerations will have longer term potential impacts.

6.1.1 Key Environmental Risks

Insufficient assessment of environmental impacts at the Design stage and failure to adequately consider the design's permanent impacts on environmental values (such as flora and fauna; surface water and freshwater ecosystems; soils) can result in potential avoidable impacts. Wherever the design involves the installation of new infrastructure such as drainage works or climbing lanes, they will potentially result in the clearing of undisturbed/less disturbed areas.

Works completed in the steep areas of the Ramu Range may result in poor slope stability and erosion and sediment movement should mitigation measures not be integrated into design works. This risk is exacerbated by potential seismic activity. Slope stability is important for both erosion and public safety and needs to be understood and controls incorporated into design before the roadworks occur. Additional detail will be included in the Final ESIA on completion of a geotechnical study.

Other environmental impacts that might occur due to inadequate design works include: spills from the slurry pipeline running adjacent to sections of the Ramu Highway, localised loss of biodiversity to the Garim WMA and Balek Wildlife Sanctuary (Ramu Highway), degradation of water quality for adjacent water courses and injuries or fatalities to road users. Poorly located or designed ancillary structures may also lead to negative environmental risks and impacts such as unnecessary clearing of vegetation and degradation of water quality.

6.1.2 Key Social Risks

The key social risks for the design phase relate to undertaking adequate social assessment of the Detailed Design. This includes considering issues such as market site planning and road safety. Efforts to minimise land acquisition and resettlement (displacement) impacts will also be important through design for worksites outside the existing

road corridor. Addressing community concerns and planning for land access is another key area that will require meaningful consultation with affected people.

6.1.2.1 Road Safety

A key area to consider during design is road safety. Potential impacts from poor road safety relate to human injuries and death which can also lead to community tensions and possible conflict (e.g. community violence towards the vehicle driver). In PNG it is common to have substantial pedestrian traffic along roads, while pigs, dogs and other livestock are another source of accidents which can also cause conflict. The risk of crashes due to steep terrain will be greater in the Ramu Range (e.g. between Usino Junction and Tapo Ford), whereas speed may be a greater issue in the flat Ramu Valley and flatter sections of the Hiritano Highway.

The project will commission a Road Safety Audit to be conducted by a qualified road safety specialist. This assessment will consider issues such as traffic speed, pedestrian movements and crossing points, traffic near sensitive receptors such as schools, dangerous corners, and sections with steep side drop-offs. The Road Safety Audit will involve fieldwork and desk studies as appropriate to deliver reports in two parts: a) existing situation – baseline analysis with recommendations for general and specific measures to be included in the designs, and b) designs –review of design reports, drawings and specifications with recommended modifications / additions to incorporate the Road Safety Audit recommendations. This work will be informed by safety statistics, onsite traffic observations, consultation with communities about how they currently use the road, road safety concerns and possible road treatments.

6.1.2.2 Highway Market Site Planning

A number of market areas may be temporarily affected by works, and small stalls and market vendors may experience temporary disruptions to business.

Management of the Kawavur Market in the central Ramu Range on the Ramu Highway presents an excellent opportunity for enhancing the positive impacts of the roadworks. Design will include site planning in consultation with market vendors and traditional communities to determine the best specific location of the future market site and creation of appropriate parking areas (for PMVs - Public Motor Vehicles and private vehicles) to provide adequate road safety and convenience. Other considerations are sufficient area for market stalls and for people to gather, adequate lighting and safety for women.

There will also be other informal markets in other sections of the Ramu Highway and also possibly the Laloki to Brown River section of the Hiritano Highway.

6.1.2.3 Land Access and Displacement

Road corridors for both highways are understood to have been acquired by the Government in the 1990s and 2000s. Confirmation of the acquired road corridor width will need to be confirmed during project design. There will be additional considerations for areas where the road is expanding beyond the existing corridors such as new climbing lanes on the Ramu Highway and possible realignment. There will also be temporary use of land for a camp and storage areas. This will require consultation and negotiation with landowners and documented land use agreements. A key point is that for most of the Ramu Highway works will be predominantly minor rehabilitation and maintenance. There were previous maintenance contracts along much of these areas so the situation and required activities should be readily apparent. This is with the exception of the Ramu Range area where major works will be required. For the Hiritano Highway the focus of the works will be rehabilitation.

The project will not require significant economic and physical displacement; however, some residential structures may be impacted and require to be moved back/re-established outside the corridor. Reconstruction and rehabilitation works may also impact small structures, economic crops and trees and other assets that are present within the road corridor.

Mitigations regarding land access and displacement will be in accordance with the project's Resettlement Framework. This will include conducting meaningful consultations and awareness for any areas that require the corridor to be established or expanded. There will also be an inventory of assets within the corridors which will be

affected by sub-project rehabilitation activities. Sub-project resettlement plans will be developed as required in accordance with the project's resettlement framework.

6.2 Construction Phase

During Construction, potential social and environmental impacts are both short and long term in nature. There will be substantial variation in the type of construction between different road sections. There will be design and reconstruction of a 40-45 kilometres steep section of the Ramu Highway, with performance-based maintenance of the full length (mainly flatter areas) of the Ramu Highway. There will be rehabilitation of the heavily trafficked 24 kilometres section between Laloki and Brown Rivers.

Construction works will largely occur on the existing road but there will be some increase in footprint, for example due to the requirement for laydown areas and new climbing lanes for the Ramu Highway. Generally, the construction phase presents the majority of the environmental and social risks. This section also considers the potential risks and impacts associated with ancillary infrastructure.

6.2.1 Key Environmental Risks

Construction will result in temporary environmental impacts, particularly with regards to dust, erosion and sedimentation, noise, hazardous materials, waste and weeds.

6.2.1.1 Biodiversity

Construction phase impacts on vegetation and fauna habitat are mostly associated with clearing practices. The impacts of clearing native vegetation can be substantial and it is now generally recognised that this activity is a major factor in contributing to the loss of biological diversity. Common impacts resulting from the clearing of native vegetation are summarised below.

Local or complete loss of rare flora species – There is limited data regarding flora species in the project area. Clearing has the potential to cause localised or complete loss of rare flora.

Loss of local fauna populations – Biological diversity may be impacted through the destruction of habitat. For species that are common and widespread, localised population loss may occur due to the clearing of native vegetation. For species with a more restricted distribution, a total extinction may occur.

Habitat fragmentation – Clearing of native vegetation often results in fragmentation, the process by which initially contiguous areas of habitat are separated into a number of smaller areas. Fragmentation impacts include the creation of small, isolated populations with limited gene flow between populations, leading to inbreeding and reduced potential to adapt to environmental change. Increasing the edge/area ratio increases the impacts of edge effects such as the susceptibility to invasion by non-indigenous species. The response of particular species to fragmentation will be affected by the mobility of the species and the scale of the fragmentation relative to the environmental scale of the species habitat.

Increased invasive species habitat – The creation of increased edge habitat and disturbed habitat may permit the establishment and spread of exotic species that may displace native species.

The RTP focuses on Reconstruction, Repair, Rehabilitation and Maintenance of existing road easements. As such, there should be only isolated locations along the road easements where clearing may be needed. The amount of clearing required, and therefore associated impacts, will increase in line with the need to align or realign road alignments and associated infrastructure in undisturbed areas. Less clearing of native vegetation is also anticipated along the Hiritano Highway due to the relative flat terrain and therefore less need for significant drainage works or land stability controls. However, through the Ramu Range there is likely to be works in undisturbed areas from the installation of Climbing Lanes, drainage structures and land stability controls.

It is important to ensure that field surveys are undertaken during prior to Detailed Design to qualify and quantify any impacts resulting from disturbance activities if they are carried out near the Wildlife Sanctuaries, Wildlife Management Areas and Conservation Area or areas protected by international conservation agreements and involve

vegetation clearing or could potentially result in contaminated runoff entering drainage lines within them. The impacts and controls should be assessed and integrated into the Final ESIA. As stated in *Section 4.1 GoPNG Requirements* if there is "a significant risk of serious or material environmental harm" to one of these areas, an EIA will be need to be conducted in accordance with Division 3 of the *Environment Act* and approval sought from the Minister.

Construction activities will create significant noise and dust disturbance to the habitats of local fauna. This can impact the life-cycle of fauna. The noise of road construction and road traffic can startle nearby animals, causing a physiological stress response. As a consequence, animals may move away from the noise affected area, either temporarily or permanently. It can also interrupt reproductive cycles. Surveys should occur i) where the project area intersects areas of high biodiversity value; ii) areas that require additional disturbance such as road realignment, climbing lanes or the installation of drainage structures; and iii) water body crossings.

Further details on the survey requirements are provided in *Section 1.5.3 Final ESIA*.

6.2.1.2 Resource consumption

Road reconstruction, rehabilitation and maintenance works involve the consumption of raw materials such as sands and aggregates as well as smaller amounts of water and energy. Appropriate materials sources will be identified in the Final ESIA in compliance with both the ESF and any permitting requirements and this section updated accordingly.

Further details on the survey requirements are provided in *Section 1.5.3 Final ESIA.*

6.2.1.3 Noise and vibration

Construction noise will occur due to earthworks, road rehabilitation and vehicle movement along the highways. Numerous villages and settlements are located along or in proximity to the highways and are therefore susceptible to increased levels of noise and vibration as a result of construction activities.

Noise disturbances are particularly likely during the construction related to the use of heavy machinery (e.g. grubbing, laying and rolling road base, rock breaking, generators etc.), transportation of materials and the operation of ancillary plant such as camps, concrete batch plants, quarries and asphalt manufacturing. Additional movement of trucks will increase the traffic levels in the area. These impacts are short-term and affect different people and different times.

6.2.1.4 Air emissions

Air pollution can arise due to improper maintenance of equipment, dust generation and bitumen smoke/fumes from the application of new pavement or burning of waste. Impacts are expected to be localised and short term with only minor negative impacts on the ambient air quality in the vicinity of the construction zone.

Key contributors to dust from construction include:

- Clearing (e.g. vegetation, topsoils, bare ground);
- Bulk earthworks (excavation, dozing);
- Grading;
- Stockpiling (e.g. borrow material);
- Burning (e.g. vegetation, rubbish) Operation of heavy mobile equipment;
- Crushing and handling plant relating to concrete batching and asphalt manufacturing; and
- Crushing, handling and transport of rock materials from quarrying.

Air quality impacts will be most severe during dry periods when there is little soil moisture.

Impacts from the generation of airborne dust are expected to be most significant in proximity to populated areas due to potential health consequences (e.g., respiratory issues) and nuisance (e.g. dust deposition on surfaces). Impacts on surrounding vegetation are not expected due to the frequent and elevated rainfall that will rinse deposited dust from plant foliage.

6.2.1.5 Stormwater

As discussed in Section 5.1.2 both highways are located in areas with (sub)tropical climates and high rainfall which will result in the frequent generation of stormwater.

During construction (including quarry operations), soils and subsoil materials become exposed making them more susceptible to erosion from surface water flows potentially resulting in turbid water flows during storm events. The Final ESIA will not whether soils are dispersive and, as such, particularly susceptible to erosion. High rates of erosion would result in depleted topsoil stocks and potential negative impacts to downstream water users.

Impacts could be exacerbated by stockpiles located in the vicinity of watercourses, poor erosion and sediment control and hydrocarbon management practices or the completion of works during the wet season.

6.2.1.6 Hazardous Chemicals

Fuel and oil will be transported along highways to be stored at camp or work sites. There will be workshop and laydown areas generating waste oil. Maintenance or breakdowns may lead to minor hydrocarbon spills. Incorrectly transported, stored, and disposed hydrocarbons may result in contaminated land and groundwater. Heavy rainfall in the constructions areas means contamination from hydrocarbon spills is more likely to enter waterways.

As discussed in Section 5.4.1, the Ramu Nickle slurry pipeline closely follows the road alignment for approximately 35 kilometres in the Ramu Range. The pipeline, which transfers lateritic nickel-cobalt slurry from Kurumbukari to Basamuk, is laid partly above ground and crosses under the road in several places. Failure to check for services prior to excavation works or vehicle collision with the pipeline could result in nickel slurry spills contaminating soils and water courses. Chronic exposure to nickel may be responsible for a variety of adverse effects on the health of human beings, such as lung fibrosis, kidney and cardiovascular diseases and cancer of the respiratory tract. Excess nickel concentrations may also pose risk to ecological communities in water, sediment and soils. A significant slurry spill could also result in high turbidity levels of stormwater and receiving water courses.

6.2.1.7 Weeds

During construction mobile equipment, aggregates and workers have the potential to carry in weed propagules that can spread in the construction area and in downstream catchments. Trucks and light vehicles, in particular, can transfer weed propagules over great distances. Where weeds establish themselves, they can reduce the habitat value of the local vegetation by outcompeting native species.

6.2.1.8 Soils

Soils may be impacted through a number of construction activities including:

- Contamination due to inappropriate refuelling or vehicle servicing procedures
- Contamination due to oil or hydraulic leaks or spills on plant and equipment
- Contamination due to leaks or spills of other materials
- Contamination via inappropriate waste disposal
- Erosion and scouring due to clearing and/or poor storm water management
- Compaction through vehicle movements.

Contamination related impacts are likely to be limited to discrete areas where works are undertaken (e.g. spills during refuelling, vehicle servicing in parking areas or from inappropriate storage of chemicals). Conversely, erosion and scouring impacts are expected to be widespread, particularly where significant ground disturbance has occurred. These effects can cause stability issues and lead to excessive sediment loads in watercourses.\

6.2.1.9 Waste

Solid waste in the form of general waste, recyclable and non-recyclable inorganic waste, organic biodegradable waste, hazardous waste and construction waste will be generated by project activities. Solid waste includes:

- General waste (i.e. office type waste, household waste (from any workers camps), lightweight packaging materials)
- Recyclable waste (i.e. certain plastics, metals, rubber, etc. that can be recycled)
- Organic biodegradable waste (i.e. waste that will decay/break down in a reasonable amount of time, such as green waste, food waste)
- Sewage and greywater
- Inorganic non-recyclable waste (i.e. waste that cannot decompose/break down and which cannot be recycled)
- Hazardous waste (i.e. waste oil, etc.).

Road Reconstruction, Repair, Rehabilitation and Maintenance generates wastes that must be managed. A key waste streams for the project will be road and road infrastructure demolition waste. The generation of these types of wastes has the potential to cause adverse environmental impacts. These include the pollution of air and water, contamination of land and groundwater, and the loss of productive land use at landfill sites. Examples of typical road demolition waste streams includes:

- Asphalt waste and other excavated road materials
- Aggregates
- Concrete.

Grit, sediment, litter and gross pollutants collect in, and removed from stormwater management systems are also a significant road related waste stream which will require routine maintenance to ensure that the stormwater management systems are not overloaded.

As discussed in Section 5.1.6 illegal dumping and burning of waste are common in PNG. The incorrect disposal of waste can result in land and surface or ground water contamination as well as potential impacts on community health and safety such as through contamination to drinking water or increased $PM_{2.5}$. Dumping of construction waste to nearby water ways may cause blockage of water flows, affect water quality and aquatic animals' biological cycles (e.g. migration, spawning).

Uncontrolled wastewater discharges have the potential to contaminate soil and water. Impacts may include sedimentation and an increase in nutrients impacting water quality and aquatic life in the adjacent water bodies, and contamination due to an accidental release of hazardous substances (e.g. hydrocarbons), refuse or other waste materials into the receiving environment. Wash water from equipment can be contaminated with hydrocarbons (e.g. oil and fuel) which have a detrimental effect on aquatic life, water quality and soil quality.

6.2.1.10 Decomissioning

Poor decommissioning may result in abandoned plant, rubbish, hydrocarbon spills etc. causing environmental impacts (such as surface water, groundwater or soil contamination) at the end of the construction phase activities where facilities such as worker camps and laydown areas were previously located.

Unrehabilitated disturbed land and stockpiles are likely to result in ongoing erosion and sedimentation impacting the water quality of neighbouring waterways.

Should quarries not be decommissioned and rehabilitated to be safe, stable and non-polluting, they may result in environmental (erosion and sedimentation) and public safety (slope failure) impacts.

6.2.1.11 Key Occupational Health and Safety Risks

Road reconstruction, rehabilitation maintenance and associated works (e.g. quarry operation) may result in occupational health and safety risks and impacts such as injuries, fatalities and health impacts.

Common risks and impacts are listed below:

- Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries in construction
- Slips and falls associated with poor housekeeping
- Exposure to harmful dusts and fumes
- Exposure to hazardous materials
- Vehicle-veichle or vehicle-pedestrian collisions
- Slope failure (both in quarries and steep sections of the Ramu Highway)
- Exposure to communicable disease (e.g., COVID-19)
- Non communicable diseases (e.g. silicosis)
- Poor occupational health and safety management practices (as is common in PNG where occupational health and safety regulation and its implementation can be weak) result in an increased probability of injuries, fatalities and health impacts occurring as a result of project activities.

High Hazard Activities

High hazard activities are those activities that might result in a fatality or permanent disability. Key high hazard activities associated with RTP works include the use of heavy machinery, working on or adjacent to public roads and slope failure.

Road works and quarrying activities have a high associated risk of vehicle to vehicle or vehicle to pedestrian collisions such as from passing cars or pedestrian workers entering heavy vehicle areas. Example of incidents might include workers being struck by swinging excavators or reversing plant. Risks are exacerbated in PNG due to the prevalence of speeding and driving whilst intoxicated.

Works on the Ramu Ranges and in quarries may be adjacent to steep slopes resulting in a risk of i) vehicles driving over the edge of the slope; and ii) slope failure burying vehicles or workers. Slope failure is exacerbated by heavy rain and seismic activities in the vicinity of the two highways. Additional detail will be included in this section of the Final ESIA based on the findings of geotechnical studies to be completed to inform detailed design works.

6.2.2 Key Social Risks

The key social risks for the Construction phase relate to potential disputes about community labour, public health and safety, property damage and access and disruption to livelihoods.

6.2.2.1 Public health and safety

The presence of an external workforce creates public health and safety risks for Project works on both highways. The operation of the camp(s) on the Ramu Highway may particularly expose the community to a variety of influx related

social risks including public health and safety and other labour issues resulting from an in-migrating workforce (along with positive local economic opportunities). A camp for the Hiritano Highway may not be required if it is deemed feasible for the workforce to commute daily from Port Moresby. Risks relating to AIDs/HIV, sexual exploitation and abuse and sexual harassment are expected to be higher for the Ramu work given the greater remoteness and challenges for monitoring and greater reliance on camps (onsite accommodation).

A Workers Health and Safety Sub-plan will be developed which will include a COVID Safety Protocol, Workers Code of Conduct, incident reporting, other safety measures and a program of awareness activities for employees and communities. A Gender-based Violence, Gender and Social awareness and HIV/AIDS prevention sub-plans will be prepared and implemented.

Public safety may also be impacted by vehicle-vehicle or vehicle-pedestrian impacts where constructions work occur on or adjacent to public highways and poor environmental management practices (i.e., resulting in contaminated water, dust and noise emissions and public nuisance).

6.2.2.2 Community Labour Disputes

There will be employment of local workers to meet Project needs and to meet local community expectations. However, the inequitable provision/hire of labour is a common source of disputes in PNG. There will not be enough work to go around to all applicants. There will be a practical challenge in implementing an equitable recruitment process and demonstrating to the community that this process has been fair – clear procedures will be required. This will be an important area for the use of the Grievance Redress Mechanism.

There will also be efforts required by the Project to avoid the default situation of women being under-represented in the local workforce.

6.2.2.3 Property Damage and Access and Disruption to Livelihoods

Given the extensive roadworks being undertaken there is potential for some damage to property (crops and structures), reduced access for businesses and limitations on community movements (e.g. extra distance and effort to cross the highway). There is also potential for economic assets located on the slopes along the roadside to be impacted during construction (i.e. establishment of turnouts, inappropriate spoil management).

These issues are also discussed in the resettlement framework. As noted above these issues are likely to be more significant for the Ramu Range where the slopes are steeper and there is a greater roadside concentration of people and assets. For the Hiritano Highway the key property impacts will likely relate to trees and some roadside structures. It will be important to give affected property owners/users adequate notice of roadworks along with installing temporary access to affected properties where required.

6.3 Operations and Maintenance Phase

Potential negative impacts in the Operations and Maintenance phase are likely to be less severe than in the design and construction phases. While there will be some potential negative impacts in the Operations phase it will be a period where the benefits of improved road infrastructure are delivered.

Environmental and social management and mitigations measures during Operations will focus on monitoring and maintenance – e.g. road pavement condition, drainage structures, sedimentation controls, receiving waters and control of vegetation and weeds.

6.3.1 Key Environmental Risks

Operational phase impacts are more difficult to predict and quantify than construction phase impacts. These impacts occur following completion of construction activities when the Highway is opened for public use and typically occur as a result of differing conditions compared to pre-upgrade conditions and associated with ongoing maintenance. The main changes following completion of upgrade activities are likely to be related to increased traffic volumes, a broader range of materials being transported and greater overall road speeds.

Potential operational phase impacts associated with day-to-day use of the Highway are provided in the following subsections. Where appropriate, management measures are recommended to aid in minimising identified impacts.

The key potential environmental impacts for this phase relate to erosion and sedimentation of culverts and new roadside drainage. All risks and impacts included in Section 6.2.1 will also apply to maintenance activities noting that the probability of an impact occurring will generally be reduced for the smaller scale maintenance activities.

6.3.1.1 Noise

Noise levels associated with operation of the upgraded highways will be significantly lower than construction phase noise impacts (e.g. operation of heavy machinery) and are anticipated to initially be lower 'pre-construction' levels due to better surfacing. However, it may also encourage more road users which could increase background noise levels due to increased traffic volumes and overall road speeds.

6.3.1.2 Stormwater

Stormwater management upgrades to existing highway alignments will likely result in a net positive impact, improving aspects such as erosion, land stability, scouring and reduced river sediment loads.

Reconstruction, Repair, Rehabilitation and Maintenance works involving the installation of new infrastructure (such as drainage structures, climbing lanes, land stability controls etc) may initially contribute high sediment loads to drains and waterways. However, after these systems stabilise, the new infrastructure should result in decreased surface runoff, erosion, scouring, land instability, and river turbidity (and therefore reduce the cumulative impacts).

Due to the elevated rainfall and unstable soils, stormwater management requirements will form a key component of the Operations and Maintenance Phase.

Stormwater management infrastructure will require regular maintenance due to sedimentation. Furthermore, downstream impacts on water quality are also a possible concern.

Key Occupational Health and Safety Risks

Occupational health and safety impacts will relate to ongoing maintenance and associated activities such as the operation of quarries. All risks and impacts included in Section 6.2.2 apply.

6.3.2 Key Social Risks

Key positive social impacts from the operation of the Highways will be enhanced road safety, improved access to services and markets and employment opportunities – particularly for women. Maintenance of the highway is also expected to result in improved air quality (reduced roadside dust) for communities along the highway.

Community health and safety is the key social risk during the operation and maintenance phase. Community feedback will be obtained on any road safety issues to incorporated into road management and treatments (e.g. pedestrian crossing at sensitive receptors such as schools). Community engagement will be important to deliver community road safety awareness activities with a focus on sensitive receptors (i.e. markets and schools) and vulnerable groups (women and children).

Public safety may also be impacted by vehicle-vehicle or vehicle-pedestrian impacts where constructions works occurs on or adjacent to public highways and poor environmental management practices (i.e., resulting in contaminated water, dust and noise emissions and public nuisance).

6.4 Cumulative and induced risks

Cumulative impacts refer to the net result of environmental impacts associated with this project and those associated with other existing activities. For example, increasing stream turbidity by 10 percent during reconstruction of a culvert may be determined to be insignificant. However, if an activity being conducted downstream by another party is also increasing turbidity by a further 10 percent, potential impacts to downstream flora, fauna and communities

may be more pronounced. Some direct impacts associated with Repairs, Rehabilitation and Maintenance activities may have limited individual significance. However, the overall environmental impact may be substantial when assessed in combination with similar impacts from other projects or activities.

It is important to note that Repairs, Rehabilitation and Maintenance activities may reduce cumulative impacts that are currently occurring from infrastructure that is damaged and failing. For example, if ground controls have failed, landslips are more likely and may be occurring resulting in unsafe conditions and potentially contributing sediment into downstream aquatic environments. Repair activities involving ground controls should reduce the risk of landslips.

Key environmental issues with the area surrounding the highways include clearing, habitat fragmentation, erosion and reduced water quality in downstream watercourses. It is anticipated that Repairs, Rehabilitation and Maintenance activities through the Coastal and Inland Valley Sections will result in lower and more temporary increases to cumulative impacts.

Reconstruction work to be undertaken through the Ramu Range section is expected to involve unstable slope controls, vertical realignment and/or climbing lands and drainage works. This will add to the existing disturbance associated with the current Highway alignment (e.g. clearing, habitat fragmentation, erosion), in addition to disturbances from subsistence farming, habitation, logging and mining practices. Quantification of these cumulative impacts is not possible given the preliminary stage of project development, but it is unlikely that project related impacts will represent a significant proportion of the total impacts caused by all activities or disturbances.

Development of any of the alternative alignments or climbing lanes will contribute significantly to existing impacts and disturbances on both a local and regional scale. The most significant cumulative impact will be the clearing of native vegetation and associated habitat fragmentation, which has occurred extensively due to subsistence farming and commercial logging activities, as observed on recent aerial imagery (MBS Environmental, 2015).

Induced or downstream impacts may include increased traffic and vehicle speeds which could potentially result in increased road accidents or GHG emissions. Road safety is a key component of the project and as such initiatives such as community awareness, road safety furniture etc. are expected to improve road safety overall. Improved road conditions are expected to increase fuel efficiency/reduce GHG emissions.

7 E&S Management

Table 7-1 below provides the RTP Environment and Social Management Plan. This Plan forms the basis for the development of aspect specific Sub-Plans and integration into CESMPs.

Sub-plans to be prepared will include as a minimum:

- Capacity Building
- Erosion and Sediment Control
- Dust Management
- Noise Management
- Gravel Extraction
- Quarry Management
- Construction Camp
- Waste Management
- Workers Health and Safety
- Community Engagement
- Gender Based Violence
- Emergency
- Stakeholder Engagement
- Traffic Management

Additional Sub-Plans may be needed depending upon the outcome of targeted field surveys and assessments.

Each contractor will develop a CESMP to guide execution of the contract. The CESMP will be developed integrating all commitments made in this E&S Management Plan and Sub-Plans (to be developed) (where relevant) and any commitments made following further survey and assessment works are completed during Detailed Design Phase (refer to *Section 1.5.3 Final ESIA*). Each CESMP will be reviewed and approved by the Supervising Engineer and then will form the basis for carrying out auditing and assurance activities by the Supervising Engineer.

An Operational Environment and Social Management Plan (OESMP) will be developed by the DOWH to guide environmental and social control during the operations and maintenance phase.

Note: Introduction to this section to be provided in the Final ESIA. Introductions will explain that whilst the contractor must complete their own monitoring this plan relates to the monitoring that will be completed by DOWH/EPM. The Final ESMP should include specific roles within DOWH/EPM2 who will be responsible for mitigation measures and monitoring.

Table 7-1 Environmental and Social Management Plan

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
DESIGN					
13. Lack of environmental and social resourcing and capacity Limited in-house E&S capacity within DOWH affects adequate assessment and management of ESHS risks/impacts of sub-projects.	E&S resources within DOWH and EPM2 (refer ESIA section 12) formally confirmed/recruited with clear terms of reference.	DOWH	Organisational structure; verification audit	Annually	DOWH/EMP
	Capacity building sub-plan for DOWH E&S resources is developed and implemented throughout project implementation period. Development of the Capacity Building Sub-Plan will involve: • Engaging stakeholders on capacity development; • Assessing capacity assets and needs; • Formulating a capacity development program; • Implementing a capacity development response; and • Evaluation of capacity development. Further details on the development of a capacity building plan can be obtained from *Capacity Development: UNDP Primer* (UNDP, Undated).	DOWH/EPM	Verification audit confirming that the capacity building plan is being implemented	Once-off (Detailed Design) Quarterly	DOWH/EMP

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	**Responsible**	**Method**	**Frequency**	**Responsibility**
14. Adequate environmental and social assessment of Detailed Design Insufficient assessment of environmental and social risks and impacts at the Detailed Design stage and failure to adequately consider the design's permanent impacts on environmental and social values (such as flora and fauna; surface water and freshwater ecosystems; soils; properties, houses farms, businesses, schools, places of workshop, medical facilities; cultural and archaeological artefacts and places) can result in potential avoidable impacts.	Design team has adequate qualifications and experience in sustainable design practice.	DOWH/EPM	Review of CVs	Once-off (Design)	DOWH/EMP
	Project designers to work with environment and social (E&S) specialists to ensure that the alignment and arrangement of the road infrastructure minimises direct and indirect impacts on E&S values (such as flora and fauna; surface water and freshwater ecosystems; soils; properties, houses farms, businesses, schools, places of workshop, medical facilities; infrastructure (such as power, water, telecommunications, pipelines etc.) cultural and archaeological artefacts and places). Alignment of footprint should favour areas that have already been disturbed. The draft design shall identify locations where proposed works may require additional studies to further define potential impacts. For example, where a climbing lane will be constructed in close proximity to a Wildlife Management Area, a field survey will need to be undertaken to confirm if there is likely to be serious or material impact. The following activities will need to be completed to upgrade this ESIA from Preliminary to Final: • Topography, geology and soils; • Water resources;	DOWH/EPM Additional studies: Topography, geology and soils – geotechnical engineering consultant Water resources – civil engineering/hydrology consultant Waste, quarries, gravel – designers Flora, fauna, Freshwater aquatic ecosystems, conservation areas – ecological consultants Land acquisition and resettlement assessment Consultation and socio-economic surveying	Verification design plan has been endorsed.	Once-off (Detailed Design)	DOWH/EMP

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	• Waste, quarries, gravel; • Flora; • Fauna; • Freshwater aquatic systems; and • Conservation areas. • Land acquisition and resettlement • Consultation and socio-economic surveying Details on each are provided in *the Final ESIA*. These surveys and assessments will need to be completed during Detailed Design Phase. The draft design is to be reviewed and endorsed by E&S specialists before being finalised.				
	Design is to incorporate permanent structures to reduce operational impacts on soil, water and biological resources.	DOWH/EPM	Verify design plan has effectively involved E&S specialists and that they have influenced the design to reduce impacts on E&S values	Once-off (Design)	DOWH/EMP
	Where the design is likely to result in "a significant risk of serious or material	DOWH/EPM	Carry out surveys and develop an EIA	Once-off (Preliminary	DOWH/EMP

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	environmental harm" (within a Wildlife Management Area, Conservation Area, National Park, Protected Area or any area declared under an International Treaty to which PNG is a party) an EIA will need to be conducted in accordance with Division 3 of the *Environment Act* and submitted to the Minister for approval		pursuant to Division 3 of the *Environment Act* and seek approval from the Minister of Environment and Conservation.	Project Implementation)	
	Ensuring that technical/engineering road designs include solutions to mitigate risks of natural disasters such as integrate flood control and climate resilience with road design, integrate slope stability with erosion control, and structural design to incorporate earthquake resilience.	DOWH/EPM	Verify design plan has effectively involved E&S specialists and that they have influenced the design to reduce impacts on E&S values	Once-off (Detailed Design)	DOWH/EMP
	Completion of road safety assessments in accordance with the Road Safety Screening and Appraisal Tool and incorporating technically and financially feasible road safety measures into the project design to prevent and mitigate potential road safety risks to road users and affected communities.	DOWH/EPM	Verify design includes road technically and financially feasible safety measures	Once-off (Detailed Design)	DOWH/EMP
	Conduct site planning of Kawavur Market (Ramu Highway) and other small roadside market areas as required.	DOWH/EPM	Verify site planning of the Kawavur Market and other small roadside markets	Once-off (Detailed Design)	DOWH/EMP

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	TOR for design works to ensure that (at least) the following key risk areas are considered: • Nickel slurry pipeline (Ramu) (potential spills if damaged) • Realignment/climbing lanes (Ramu) – considering land and vegetation clearing (see below) • Protection of surface water and freshwater ecosystems • Protection of Wildlife Management Areas, Conservation Areas, National Parks, Protected Areas or any area declared under an International Treaty to which PNG is a party. • Road safety – particularly around sensitive receptors (i.e. communities, schools, markets, PMV stops etc.) • Market site planning – for key markets sites (i.e. Kawavur Market – Ramu range) and other road site markets. • Sensitive receptors/vulnerable groups. The TOR shall require the integration of the findings of field surveys and studies (including but not limited to controls).	DOWH/EPM	Verify design plan has effectively considered key risk areas	Once-off (Detailed Design)	DOWH/EMP

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
15. Land Acquisition and resettlement impacts Corridors for both highways are understood to have been acquired by the Government. Road may be expanded within and beyond the existing corridors -i.e. new climbing lanes and realignment of the Ramu highway. Reconstruction and rehabilitation works may result in economic displacement including impact small structures, economic crops and tress and other assets that are present within the road corridor and any re-aligned/expanded corridor areas. Physical displacement (i.e. impacts on residences) may occur as a result of reconstruction and rehabilitation activities, however, is expected to be minor. A number of market areas may be temporarily affected by works, and small stalls and market vendors may experience temporary disruptions to business	Confirm status of road corridor for both sub-projects in consultation with affected communities.	DOWH/EPM	Verification of official GoPNG documentation and consultation records	Once-off (Detailed Design)	DOWH/EMP
	Conduct meaningful consultation and FPIC for any areas that require corridor to be established or expanded in accordance with the project's resettlement framework.	DOWH/EPM	Verification of official GoPNG documentation and consultation records	Once-off (Detailed Design)	DOWH/EMP
	Conduct an assessment of physical and economic displacement including an inventory of assets within the corridors which will be affected by RTP activities.	DOWH/EPM	Verification of assessment	Once-off (Detailed Design)	DOWH/EMP
	Conduct/develop Resettlement Action Plans (RAPs) in accordance with the project's resettlement framework that are acceptable to the World Bank including avoidance and/or mitigation measures for physical or economic displacement.	DOWH/EPM	Review of plans developed	Once-off (Detailed Design)	DOWH/EMP
	Implement RAPs in accordance with the project's resettlement framework and produce completion reports that are acceptable to the World Bank.	DOWH/EPM	Review of regular reports	Weekly	DOWH/EMP
	Land acquired for project works will not be of high biodiversity value	DOWH/EPM	Review of plans developed	Once-off (Detailed Design)	DOWH/EMP

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
16. Adequate Stakeholder Engagement and consideration of Indigenous Peoples Road rehabilitation and maintenance will affect communities in 13 wards on the Ramu and three wards on the Hiritano. These communities are all indigenous peoples and are required to be meaningfully consulted about impacts and opportunities arising from these sub-projects in accordance with the project's SEP.	Identify/confirm community groups (the local people are indigenous) and community representatives to consult with during project preparation (and implementation).	DOWH/EPM	Before worked commence – review of SEP	Once-off (Detailed Design)	DOWH/EMP
	Conduct socio-economic baseline surveying in project affected wards and villages	DOWH/EPM	Verification design plan has been endorsed.	Once-off (Detailed Design)	DOWH/EMP
	Conduct consultation, disseminate information and seek feedback from these communities on the potential impacts and opportunities arising from the project and how these can be managed.	DOWH/EPM	Review of consultation records	Weekly	DOWH/EMP
17. ESHS risks during conduct of field investigations and surveys OHS risks associated with working on and adjacent to national highways and associated with minor works (i.e. core drilling; digging profile pits etc.). Environmental risks associated with minor works (i.e. core drilling; digging profile pits etc) including: • Direct impacts on E&S values from clearing; • Dust (operation of mobile equipment, drill rigs, earthworks etc);	Consultant to provide standard operating procedures for managing ESHS risks during conduct of field investigations and surveys. Should include at a minimum: • an erosion and sediment control • noise, dust and invasive species management • worker and community health and safety management • procedures to minimise and manage vegetation clearance	Consultant	Verify SOPs have been developed for mitigating ESHS risks associated with field investigations and surveys	Once-off before commencing activity	DOWH/EMP

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
• Weeds (transfer of weed propagules from mobile equipment and workers); • Erosion and sedimentation (destabilising groundcover through earthworks); and • Noise and vibration (operation of mobile equipment). Social economic and community health impacts					
18. Adequate consideration of Sexual Exploitation and Abuse and Sexual Harassment before Construction starts. Introduction of an outside workforce creates potential issues with interaction with local people regarding Sexual Exploitation and Abuse and Sexual Harassment.	GBV service provider consultation and mapping for each sub-project	DOWH/EPM	Verification of mapping output	Once-off (Detailed Design)	DOWH/EMP
	Finalise SEA/SH Action Plan during project preparation in accordance with the World Bank's Good Practice Note for Addressing SEA/SH Risk in Investment Project Financing involving Major Civil Works.	DOWH/EPM	Verification of SEA/SH Action Plan	Once-off (Detailed Design)	DOWH/EMP
19. Adequate inclusion of ESHS requirements in Procurement Failure to include WBG and GoPNG ESHS requirements at the procurement stage poses a significant risk of the Contractor failing to implement the scope of works and commitments in accordance with WBG and DOWH requirements.	DOWH to incorporate ESHS requirements in sub-project bidding documents, which will be based on meeting PNG legislative requirements, WB E&S Standards, and Standard Bidding Documents, this ESMP and other plans proposed. These requirements have already been developed and include: • Guidelines for preparation of CESM and subplans	DOWH/EPM	Verify that ESHS requirements are in the sub-project bidding documents that meet the standards	Once-off (tendering)	DOWH/EMP

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	• General conditions • ESHS Metrics for Progress Reports • ESHS performance security				
	Contractor E&S selection criteria/conformance requirements included in tender review process. Contractors shall complete a ESHS Performance Declaration and past performance will be considered in bid evaluation.	DOWH/EPM	Verify tender evaluation	One time during tendering	DOWH/EMP
Construction					
20. Contractor ESHS management planning	Adequate contractor resources provided for ESHS	Contractor	Review of resources	Before Works Commence	DOWH/EMP
	Preparation and approval of a CESMP, including required subplans, will be prepared according to Guidelines for Contractors Environmental and Social Management Plan. This includes: a) Gravel Extraction sub-plan b) Quarry Management sub-plan c) I Construction Camp sub-plan d) Dust management sub-plan e) Noise sub-plan f) Waste management sub-plan g) Traffic Management sub-plan h) Workers Health and Safety sub-plan. i) Community Engagement sub-plan	Contractor	Approval of plans and subplans	Before Works Commence	DOWH/EMP

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	j) HIV/AIDS, COVID prevention sub-plan k) Gender-based violence sub-plan l) Emergency/contingency sub-plan The CESMP will cover: • Standards, conditions and commitments that the CESMP addresses; • Roles and responsibilities of personnel in charge of E&S works; • Risk register documenting the site-specific and project specific risks; • Details on management actions to control risks and a program for implementation; • Incident management and emergency response procedures where controls fail; • Include the reporting E&S requirements; • E&S training requirements including inductions, E&S values, E&S requirements relevant to the work activities, emergency response				

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	procedures, mitigation measures, audit and assurance processes; and • Assurance process to assure that controls are in place and working.				
21. Vegetation clearance and impacts on biodiversity Vegetation (trees, grass and small shrubs) clearance to: • Re-establish existing road corridors; • Establish permanent road infrastructure (such as stormwater management structures); • Establish construction laydown areas; • Establish working camps; • Establish pads for ancillary infrastructure (such as concrete batch plant, asphalt manufacture); and • Establish temporary erosion and sedimentation controls for construction.	Ensure that all clearing work needed to construct the Detailed Design is limited to the footprint defined in the Details Design wherever possible. Additional areas cleared to allow operation of equipment and installation of areas for ancillary facilities should be kept as small as possible. Contractor to develop and implement a CESMP that includes (but is not limited to) the following: • Identify/mark out mature or special trees and areas of vegetation to be protected[21] • Vegetation cuttings will be disposed of at a designated disposal area. • Progressively rehabilitate and re-vegetate disturbed –areas - to be carried out in all areas disturbed by the project with fast-growing, native species where practical. • Reapply stockpiled topsoil and vegetation to local disturbed areas. Maintain and reapply until	Contractor	Site inspection with photos	Before, during and after	DOWH

[21] This will be determined by the ecological consultant tasked with undertaking biodiversity related surveys and assessments referred to in *Section 1.5.3 Final ESIA*.

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
There is also the possibility of a highway realignment and construction of new climbing lanes in the Ramu Range that will require more extensive clearance.	vegetation is successfully established. • Mangroves not to be felled, removed or damaged • Contractor responsible for information and sanctions regarding harm to wildlife and felling of trees (not requiring to be cleared). • Camp, equipment and stockpiles not to be located in ecologically important or sensitive areas. • Water depth to be maintained at bridges and culverts to allow migrating species to move up and down rivers.				
	Further investigation of biodiversity and ecological values potentially impacted by project activities will be completed during Detailed Design Phase (refer to *Section 1.5.3 Final ESIA*) will be included in the Final ESIA. Depending on the results of these investigations, the consultant tasked with carrying out further assessments into biological matters (e.g. flora, fauna, aquatic ecosystems or conservation areas) will determine the need to develop a biodiversity management sub-plan (BMP). The BMP would cover arrangement to prevent direct impacts, protection of	DOWH	Plan approved by DOWH Verification that the plan is being properly implemented	One time before commencing 3M	DOWH/EMP

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	significant ecological values at locations where works could impact local biodiversity, weed hygiene practices, timing of works to minimise disruption and progressive rehabilitation of disturbed areas.				
22. Community concerns Community unrest, dissatisfaction and social disruption due to pre-construction and construction activities including mobilisation of contractor, presence of construction workers, worker associations with local people. Community lacks information about the project and/or community grievances are not resolved potentially negatively impacting the community members and/or leading to community unrest.	Implement a SEP and Grievance Redress Mechanism (GRM). This will include adequate recording and community awareness raising for the GRM.	DOWH/EPM	Consultation and grievance records	Monthly	DOWH/EMP
	Implement Contractor Community Engagement Subplan – including project GRM.	Contractor	Review of contractor reports	Monthly	DOWH/EMP
23. Workforce Health and Safety Physical hazards associated with operation of equipment, conditions at worksite, movement of materials with potential for serious injury or death.	A separate workforce health and safety sub-plan will be developed as part of the CESMP or as directed in the contract. This will include: • Safe Work Method Statements • OHS training requirements • Monitoring and assurance • Incident management and emergency preparedness • Risk assessment and change management	Contractor	Check contractor records, consultation with employees, coordination with Department of Health, site inspection	Monthly	DOWH/EPM2

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	• Use of personal protective equipment (PPE) • Conduct of toolbox talks and training • OHS incidents (including near misses) reported and managed as per the contractors' incident reporting procedure.				
	As per Condition GN28.2 of ESS2 Labour and Working Conditions, all services provided to workers including camps and canteen facilities shall be provided in a non-discriminatory manner.	Contractor			
24. Air Quality Emissions from construction vehicles and equipment. Air quality impacts on workers and local communities (nearby sensitive receptors), breach of air quality standards caused by particulate pollution (dust) during site clearance, excavation works and drilling operations and emissions from use of fuel powered equipment.	Prohibition of use of equipment that causes excessive pollution (e.g. generates smoke).	Contractor	Check of equipment visible smoke or another vehicle emission	Monthly	DOWH/EPM
	Maintain machinery in good working order in accordance with the OEM's requirements for air pollution control.	Contractor	Routine audit of maintenance records	3M	DOWH/EPM
	Develop and implement a Dust Management sub-plan (DMP) for the construction work where disturbance is to occur. DMP should consider controls such as water carts, sprayers, surface treatments etc. and address (at least) the following points (and may be integrated within the CESMP): • Vehicles transporting dust-producing material not overloaded,	Contractor	Plan approved by DOWH Verification that the plan is being properly implemented	One time before commencing 3M	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	provided with tailboards and sideboards, and adequately covered. • Material stockpiles located in sheltered areas and to be covered. • Manage dust near sensitive receptors (particularly schools, hospitals and markets) including avoiding conduct of dust generating activities in windy conditions, spraying exposed areas (earthworks, stockpiles, roads, trucks carrying spoil). • Damping down of the access road during the dry season. • Construction vehicle exhaust systems and noisy equipment will be maintained to minimize noise. • Contractor will develop a schedule of operations with community leaders and DOWH to identify days of no work and hours for certain activities. • Air quality issues/concerns of the community monitored through consultation (SEP) and the project GRM and resolved accordingly.				
25. Noise and Vibration Nuisance level noise and vibration generated by intermittent operation of plant and equipment.	Develop and implement a Noise Management sub-plan (NMP). The NMP should cover as a minimum (and may be integrated within the CESMP):	Contractor	Plan approved by DOWH and WB	One time before commencing	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
Sensitive areas include schools and dwellings. **26.** Noise will mainly relate to resurfacing works on both the Ramu and Hiritano Highways.	• the need to select low noise equipment; • use of equipment such that they emit low noise (e.g. preventing speeding, leaving equipment on when not in use etc.); • ensuring that noise emission controls are maintained, and noisy faults are rectified quickly such that noise levels are minimised; • Noise and vibration levels in receiving environment will not exceed standards outlined in the WB General EHS guidelines. Where a significant concern is raised, and potential issue is identified, monitoring will be undertaken; • work arrangements that reduce the impact on the community (e.g. days of no work, prohibit activities between 9pm to 6am, notifying the community before commencing loud activities etc.); • Non-routine notice protocol with community leaders; • Noise and vibration issues/concerns of the community monitored through consultation (SEP) and the project GRM and resolved accordingly;		Verification that the plan is being properly implemented	3M	

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	• Use noise generating plant and equipment only as required. Turn off when not in use; • Regular toolbox talks with workers to ensure noise is kept to a minimum; • Noise monitoring and TARPs.				
27. Water Quality Adverse impacts on downstream surface water quality (sediment transport, brine/saline water and hydrocarbons).	Develop and implement an Erosion and Sediment Control sub-plan (ESCP). The ESCP should cover diversion and containment structures, slope support and spoil and stockpile protection measures. It should also include monitoring of downstream water quality and performance of drainage and retention systems. Particular attention should be given to activities that are to be carried out within close proximity to water ways (especially on riverbanks) and the coast. The ESCP should consider (at least) the following: • Construction works in areas of river (especially riverbank) streams and the coast to be undertaken with extreme care. • Use of silt control devices and sediment traps/fences during bridge and culvert works and extraction activities with regular cleaning and maintenance. • No dumping of spoil in streams or rivers;	Contractor	Plan approved by DOWH Verification that the plan is being properly implemented	One time before commencing 3M	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	• Gabion baskets or rock rip rap to be used for embankments when suitable. • Spoils and stockpiles will not be located on or near slopes or within flood zone of river and streams. • Placement of diversion ditches around stockpiles. • Pass storm water runoff from construction and stockpile areas through geotextile silt traps before discharge into culverts or drainage systems. • Abstraction from streams requires the signed permission of landowners. No pollution of streams allowed. Zero discharge of any polluted water. • Streams affected by construction require detailed site-specific management plans for repair and rehabilitation. • Topsoil is preserved in designated storage areas and reused as soon as possible to promote and stabilise endemic species. Topsoil will be conserved with its leaf litter and organic matter. • Endemic species to be preferred unless there are technical reasons for using introduced species.				

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	• After completion of works all areas edging streams to be restored to original condition as quickly as possible with suitable mix of trees and shrubs to promote stabilisation of soils and enhanced for improved access to the extent possible. • Temporary structures to minimize any reduction of river and stream flows. • Temporary structures removed on completion of works and riverbed restored. • Side slopes of embankments designed to reflect soil strength. • Scour protection as needed. • Minimise size and duration of cleared areas and undertake progressive re-vegetation of cleared/work areas. • Stockpile suitable material (e.g. topsoil, rocks, alluvium) and use in the event of channel or bank erosion. • Avoid clearing activities during rainy season where possible. • Natural water flows in streams will not be interfered to the extent possible. • Use of heavy machinery in nearby smaller more sensitive freshwater				

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	aquatic environments to be minimized. • Good design used in all construction activities to minimize need for changes to natural gradients. • No discharges of petroleum, oils, and lubricants to surface water stream. • Water quality issues/concerns of the community monitored through consultation and the project GRM and resolved accordingly. • Water quality levels in receiving waterways will not exceed standards outlined in PNG legislation and WB General EHS guidelines. Where a significant concern is raised, and potential issue is identified, monitoring will be undertaken. The content of the ESCP will be informed by the Topography, geology and soils field surveys and assessment to be undertaken as per *Section 1.5.3 Final ESIA*.				
	Include a requirement to develop and implement a Hazardous Materials Management Plan (including refuelling procedures, spill response procedures and correct and safe storage, handling and disposal of hazardous materials) in contractor bidding documents.	Contractor	Plan approved by DOWH	One time	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
28. Erosion and sediment transportation, loss of topsoil, spoil. Potential increases in total suspended solids and sedimentation downstream of construction sites caused by vegetation clearance, equipment washdown.	Refer to controls for 15. Water Quality.				
29. Quarry Management	Where a new quarry must be established or re-opened for the RTP a Quarry Management sub plan (QMP) will be developed under the supervision of the CEPA[22] and in consultation with relevant stakeholders (including people potentially affected by the operation of the quarry). The QMP will be developed to meet DOWH's Code of Practice and the World Bank's E&S Framework. In either case the QMP is to be submitted to the Engineer's Representative and the Project Manager's Supervising Engineer for discussion and approval. The QMP must include but not be limited to: • Erosion and sedimentation control measures; • Diversion drains around stockpiles and the active quarrying areas to reduce the risk of sediment laden runoff;	Contractor	Plan approved by DOWH and WB Verification that the plan is being properly implemented	One time before commencing Monthly	DOWH/EPM

[22] Where the quarry will be producing more than 100,000 tonnes of material a quarry permit will need to be issues from the CEPA.

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	• Not overloading vehicles and using tall-boards and side-boards when transporting quarrying materials and damping down loads being carried in open trucks to reduce the risk of dust; • Material stockpiles (including topsoil and overburden) located in sheltered areas, diversion drainage installed and covered; • Damping down construction sections during the dry season and dry periods; • Traffic control measures to reduce the risk of collisions of trucks carrying quarried materials with other road users; • Selection of low noise equipment; • Operating equipment such that noise emissions are minimised; • Operating the quarry during day shift only (i.e. no operations between 9pm and 6am) and not on weekends; and • Dust controls for quarrying equipment such as crushers. • Community and worker health and safety. Before developing any new quarry, an impact assessment will be required and, where Division 2, Section 44 of the *Environment Act* is triggered, an environmental permit from the GoPNG.				

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	A checklist will be developed noting what the contractor must do for established quarries and for new quarries (including the requirements of any environment permits.				
30. Gravel management	If gravel needs to be secured, a Gravel Extraction sub-plan (GEP) will be developed in consultation with relevant stakeholders (including people potentially effected by activities involved in gravel extraction). The GEP will be developed to meet DOWH's Highway Maintenance Specifications (Department of Works, 2017). The GEP is to be submitted to the Engineer's Representative and the Project Manager's Supervising Engineer for discussion and approval. The GEP must include but not be limited to: • Erosion and sedimentation control measures; • Diversion drains around stockpiles and the active gravel extraction areas to reduce the risk of sediment laden runoff; • Not overloading vehicles and using tall-boards and side-boards when transporting materials and damping down loads being carried in open trucks to reduce the risk of dust;	Contractor	Plan approved by DOWH and WB Verification that the plan is being properly implemented	One time before commencing Monthly	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	• Material stockpiles located in sheltered areas, diversion drainage installed and covered; • Damping down construction sections during the dry season and dry periods; • Traffic control measures to reduce the risk of collisions of trucks carrying materials with other road users; • Selection of low noise equipment; • Operating equipment such that noise emissions are minimised; • Operating the gravel extraction areas during day shift only (i.e. no operations between 9pm and 6am) and not on weekends; and • Dust controls for gravel extraction and haulage equipment such as crushers. • Community and worker health and safety.				
31. Land use changes and restrictions Works will be largely confined to the established road corridor apart from possible climbing lanes and ground support and drainage infrastructure at the Ramu Range. There will be temporary land use requirement for ancillary facilities such as	Wherever possible Repair, Rehabilitation or Maintenance Works will be conducted within the existing road corridor and sites secured by the contractor for temporary use for ancillary facilities.	Contractor	Site inspections; Review of contractor progress reports	Monthly	DOWH/EPM
	Consultation/negotiation with landowners and documented 'market transaction' agreements for temporary use of site(s) for ancillary facilities during construction and the	Contractor	Verification of relevant site plans/agreements	Once-off	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
the worker camp (for at least Ramu) and quarries (for Ramu). There may also be requests from the community for the contractor to conduct 'off-site' works (i.e. provision of backfill to communal/private properties).	rehabilitation and return of site(s) upon demobilisation.				
	Contractor to avoid sites where people without formal, traditional, or recognisable use rights are occupying sites.	Contractor	Site inspections; Review of contractor progress reports	Monthly	DOWH/EPM
	Submission and approval of ancillary site plans (including documented agreements with land holders) before use of site.	Contractor	Verification of relevant site plans/agreements	Once-off	DOWH/EPM
	Existing sites (i.e. quarries, workcamps, batching plants etc) to be used where possible to avoid impacts on additional areas.	Contractor	Site inspections; Review of contractor progress reports	Monthly	DOWH/EPM
	Sites for spoil placement to be identified in consultation with DOWH, Province, landowners and communities. Documented agreements for spoil sites.	Contractor	Verification of relevant site plans/agreements	Once-off	DOWH/EPM
32. Unforeseen Property Damages All works will be conducted within the established road corridor (i.e. covered under the ARAP) and sites that have been secured by the contractor in agreement with landowners. However there is potential for minor impacts on economic trees, crops and structures (i.e., fences) outside of these areas.	Payment for unforeseen damages to structures or economic assets during construction to be facilitated by the contractor	Contractor	Site inspections; Review of contractor progress re–orts - Signed agreements and payment receipts sighted	Monthly	DOWH/EPM
	Monitor any property damage related issues through the project GRM	Contractor & DOWH	Review of GRM register; Review of contractor progress reports	Monthly	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
33. Restricted property access Temporary impact access to private and public properties (i.e., driveways). A number of market areas may be temporarily affected by works, and small stalls and market vendors may experience temporary disruptions to business.	Community is consulted about the construction schedule and when road and other works will occur, with particular engagement with property owners.	Contractor	Review of contractor progress re–orts - Consultation activities and records	Monthly	DOWH/EPM
	Property owners are consulted at least 48 hours before works commence outside their properties.	Contractor	Review of contractor progress re–orts - Consultation activities and records	Bimonthly	DOWH/EPM
	Install temporary access to affected properties where required.	Contractor	Site inspections; Review of contractor progress reports	Monthly	DOWH/EPM
	Works' supervisor will maintain regular contact with property owners and manage any access issues as they may arise.	DOWH/EPM	Site inspections reports	Monthly	DOWH/EPM
34. Solid Waste and Liquid Waste impacting surrounding environments General waste (plastics, paper etc.) generated at construction sites. Liquid waste (grey water and sanitary waste) generated at the Water Treatment Plant.	Develop and implement a Waste Management sub-plan (WMP) for all generated waste streams (e.g. road demolition waste, hazardous waste, putrescible waste, inert waste, excavated materials, sewage etc.). The WMP shall contain but not be limited to: • Systems and processes for minimising waste generation and driving the waste management hierarchy[23] (reuse, recycle and	Contractor	Plan approved by DOWH Verification that the plan is being properly implemented	One time before commencing 3M	DOWH/EPM

[23] Road demolition waste presents significant waste recovery potential. For example, reclaimed asphalt and concrete can be used as road base and sub-base or blended for use in new asphalt. It can also be used on road shoulders. Materials such as concrete, wood, bricks and steel can also be recycled.

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	recover before disposal in that order); • Systems and processes for temporary storage, handling and transport of waste that is safe, stable and non-polluting and prevents hazards such as fires, vermin or standing water/vector breeding; • Systems and processes for treating, destroying or disposing of waste in an environmentally sound and safe manner that includes appropriate emissions and residue control where waste cannot be reused, recycled or recovered; • Systems and processes for ensuring that hazardous waste is stored, transported and disposed of in accordance with GoPNG legislation and international conventions; • Use of waste management contractors that are reputable, legitimate and licenced with respect to transportation and disposal; • Establishment and management of septic and greywater treatment at camp sites and contained, toileting facilities for the workfront areas; • Prior to removal from site, segregate and store all waste in suitable areas to prevent hazards such as fires,				

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	vermin or standing water/vector breading. • Dispose of general waste at municipal landfill site or alternative facilities. • Establishment of appropriate septic and greywater treatment at camp site. • Include disposal sites with confirmation that they are licenced and operated to acceptable standards; and • Due-diligence process to confirm that actual practice is meeting the requirements of the SWMP.				
35. Hazardous Materials Transport, Storage and Waste Fuel and oil will be transported along Highways to be stored at camp site or work site. There will be a workshop and laydown area at campsite generating waste oils, oil filters, tyres etc. Some maintenance will occur offsite.	Include a dedicated section on hazardous waste management in the WMP that includes (but is not limited to): • Emergency response procedures. • Chemicals will be stored in secure containers. • Chemicals stored in bunded area or compound with concrete floor and weatherproof roof. • Spills will be cleaned up as per emergency response plan. Spill kits shall be located at fuel/oil storage sites and on mobile service vehicle. • Signage for no go smoking zones.	Contractor	Plan approved by DOWH Verification that the plan is being properly implemented	One time before commencing 3M	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	• Provide training workers on hazardous materials management and emergency response procedures and equipment e.g., extinguishers. • Plant servicing, refuelling and maintenance operations shall be carried out within designated service areas. Off-site refuelling will be conducted within designated refuelling areas with containment measures. • Compliance with national legislation, World Bank ESHGs and material safety data sheets.				
36. Cultural Heritage (Chance Finds) No cultural heritage sites have been identified during the assessment. Project sites are located on previously cleared lands and chance finds are unlikely. Overall, the Project involves the rehabilitation and maintenance of an existing highway and is not expected to impact on physical cultural resources in the area.	Site will be properly demarcated collaboratively with the local community at the start of the construction.	Contractor	Verification that the areas to be cleared have demarcated cultural heritage values	Before clearing	DOWH/EPM
	A chance finds procedure has been developed as part of this ESIA (Appendix A) Implement a Chance Find procedure that provides workers with the process for responding to Chance Finds when undertaking disturbance activities. Including: • Cease activity immediately if artefacts uncovered • Inform the National Museum	Contractor	DOWH approval of the Chance Find Procedure Verify that the Chance Find Procedure is implemented	One time 3M	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
37. Traffic and transportation impacts Potential traffic hazards associated with operation of equipment, road conditions during construction, movement of materials with potential for injury or death.	A traffic management sub-plan (TMP) will be developed and implemented during project implementation and should include as a minimum: • Be prepared in consultation with key representatives from the local community; • Notify community members in advance of schedule and duration of works. Should off peak transportation of materials be necessary, communicate ahead of time to the communities along the route that this is going to occur; • Only moving materials or equipment that are likely to impact normal pedestrian and vehicle traffic during off-peak times; • Route traffic away from community areas wherever possible; • Route transport to and from construction sites and Ancillary Operations (e.g. construction camp, laydown areas, quarries, concrete batching plants etc.) wherever possible on existing road network and on the most direct route; • Prohibiting the use of engine breaking and the use of speed control in and close to settlements	Contractor	Plan approved by DOWH Verification that the plan is being properly implemented	One time before commencing 3M	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	(reducing noise, speed and vibration) near sensitive receptors; • Establish rights-of-way, speed limits, vehicle inspection requirements, operating rules and procedures, control of traffic pattern or direction; • Adoption of best transport safety practice; • Minimise pedestrian interaction with construction vehicles; • Installation of signage; • Leaving the construction area and equipment in safe a safe state overnight with signage where it does not pose a significant risk to other drivers and pedestrians; and correcting alignments that have poor visibility and poor safety. The integration of road safety improvements to project design (including technical assistance) will address on going road safety risks post project implementation.				
38. Public health Health and safety hazards for the public on roads and at roadworks sites. This includes community health issues (i.e., AIDs/HIV, Covid 19, GBV, antisocial behaviour) associated with presence of outside workforce.	Public restricted from accessing works sites Safety of the general public safeguarded by notifications of upcoming construction activities, visible barriers around active worksites, appropriate signage, and traffic/pedestrian management during construction activities.	Contractor	Site inspections; Review of contractor progress reports	Monthly	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	Public health and safety incidents (including near misses) reported as per the contractor's incident reporting procedure.				
	Implement COVID Safety Protocol for contractor activities	Contractor	Site inspections; Review of contractor progress reports	Monthly	DOWH/EPM
	Prepare and implement a HIV/AIDs awareness sub-plan in accordance with requirements of the National AIDS Council. The contractors' program will be prepared by a National AIDS council approved service provider and include: • Staff training program • Community awareness program • Dissemination of awareness materials • Provision of condoms meeting requirements of ISO 4074 to workforce. • Provision of information on services concerning counselling, support and care of those infected.	Contractor with Qualified Service Provider	Approval of sub-plan Review of contractor progress reports	Once-off / Monthly	DOWH/EPM
	Prepare and implement a SEA/SH sub-plan in accordance with requirements of the project's SEA/SH Action Plan. The contractors plan will be prepared by a qualified SEA/SH service provider and include: • Code of conduct implementation	Contractor with Qualified Service Provider	Approval of sub-plan Review of contractor progress reports	Once-off / Monthly	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	• Staff training program • Community awareness program Grievance mechanisms and response protocol – including support to access GBV services.				
39. Community labour Local workers will be required to support the Project. Inequitable provision/hire of labour is a common source of disputes in PNG.	Develop and implement a community labour procedure - including information about employment opportunities in community consultations and utilise community leadership (including women leaders) in ensuring the equitable distribution of opportunities amongst community.	Contractor	Approval of CESMP – with labour procedure	Once-off	DOWH/EPM
	Actively promote equal opportunity for women to secure employment. Ensure at least XX percent of workforce is female.	Contractor	Review of contractor progress reports – employment data	Monthly	DOWH/EPM
	Monitor and manage grievances concerning the allocation of community labour opportunities through the project's GRM.	Contractor and DOWH			
40. Emergencies Potential emergencies might include hazardous materials spills, fire and severe civil unrest.	In cases of emergency, in the first instance to contact Works Supervisor.	Contractor			
	Ensure appropriate responses are provided for each situation. If civil unrest, then contacts Police and local District Administration.	Contractor			

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
	Develop Contractor Emergency Management Plan	Contractor			
41. Impacts on utilities and business assets There are likely to be utilities within the road corridor of both Highways, such as water and electricity. There is also a slurry pipeline from the Ramu Nickel mine that runs along the Ramu Highway.	Construction operations to physically avoid utilities and business assets.	Contractor	Verification of CESMP and relevant site plans	Once-off	DOWH/EPM
	This will be investigated in the Detailed Design phase. Contractors to implement mitigation measures outlined in the final ESIA/ESMP.	Contractor	Site inspections; Review of contractor progress reports	Monthly	DOWH/EPM
42. Slope protection and natural disasters. There are steep areas along the part of the Ramu Highway being reconstructed. There is an existing risks of slope failure which could increase with earthworks and roadworks. This poses a risk of creating landslides with potential for injuries, loss of life, damage to assets, and environmental damage.	As part of the Topography, geology and soils study (refer to *Section 1.5.3 Final ESIA*) Implement slope stability inspections and implement stabilisation mitigations when working in risky areas. Increase buffers for community access in these risky areas and when slope stabilisation works are occurring. The stabilisation mitigations are to be incorporated into the ESCP. Contractor to verify that controls have been put in place in high-risk areas	Contractor	Site inspections of high-risk areas (e.g. works in Ramu Ranges or quarries)	Monthly	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
43. Site Security Safety risk for workers, damage and loss of property	Work cam and site plans will be developed including consideration of security. This will include all equipment and containers being locked down and ensuring that all contractors workers and property are secured. Adequate security lighting and security staff.	Contractor	Site inspections	Monthly	DOWH/EPM
Operation and Maintenance					
44. Road safety Monitoring The change to a sealed road will lead to increased traffic speed and safety improvements (relating to vehicle collisions). There is also the ongoing risk of rockfalls and landslides. Positive social impacts including safer and more reliable travel, improved access to services, and women's empowerment.	Develop and deliver community road safety awareness activities with a focus on sensitive receptors (i.e. markets and schools) and vulnerable groups (women and children). Community feedback will be obtained on any road safety issues to incorporated into road management.	DOWH/EPM	Road safety awareness program; delivery records	Once-off / Monthly	DOWH/EPM
	Community feedback will be obtained on any road safety issues to incorporated into road management	Contractor/ DOWH	Consultation records	Monthly	DOWH/EPM
	Maintenance of appropriate road signage and treatments, such a speed humps and pedestrian crossing at sensitive receptors such as markets, villages and schools	Contractor	Site inspections; review of progress reports	Monthly	DOWH/EPM
45. Social, environmental and health and safety impacts during operation and maintenance including • Community concerns • Public health	Implement measures outlined for management of these impacts during construction (above)				

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
• Community labour					
46. Erosion and Sedimentation Culverts and roadside drainage can experience a build-up of sedimentation through erosion events.	OESMP to include a procedure for monitoring and managing erosion and sedimentation along the highway road easement and downstream drainage and containment structures. The procedure shall include the need to undertake inspections at the end of the dry season and following significant rainfall events and ensure that the stormwater management system (e.g. drains, culverts, gutters etc) is free of debris and the containment structures are de-sludged and allowing sediment to fall out of suspension. Erosion and sediment control whilst they are completing rehab works	DOWH	Procedure approved by DOWH and WB	DOWH	DOWH/EPM
47. Risk of poor decommissioning. This includes items such as abandoned plant, rubbish, hydrocarbon spills etc at the end of the Project.	Verification inspection and report prior to end of defects liability phase (i.e. whilst DOWH can still require the contractor to take remedial actions). Decommissioning requirements should also be included in the bidding documents.	Contractor	Review of final bidding documents	Before bidding documents are release	DOWH/EPM
		Contractor	Verification inspection and report	Prior to end of defects liability phase	DOWH/EPM

Issue/Impact	Management		Monitoring		
	Management and Mitigation Measures	Responsible	Method	Frequency	Responsibility
48. E&S impacts of quarries post-closure. Inadequate quarry closure may result in the risk of erosion and sedimentation and impacts on community safety due to poor slope stability	Appropriate treatments will be applied to quarries to address erosion, sedimentation and slope stability as part of their closure or handover to Government or another company. Contractors will develop and implement a quarry management plan including decommissioning requirements should be included. CEPA also need to inspect quarries prior to formal closure.	Contractor	Final site inspection	At end of use of quarry for Project	DOWH/EPM

8 Complaints and grievances

A grievance redress mechanism (GRM) will be established for the Project. The project GRM is outlined in the SEP. Key elements of the GRM are also outlined in this section.

8.1 Objectives

The purpose of the grievance redress mechanism is to receive, assess, and facilitate resolution of project related concerns and grievances, at no cost and without retribution.

The GRM aims to:

- Provide affected people with avenues for making a complaint or resolving any dispute that may arise during the course of the implementation of the Project
- Ensure that mutually acceptable redress actions are identified and implemented promptly, in a culturally appropriate manner, to the satisfaction of complainants
- Avoid the need to resort to judicial proceedings.

8.2 Grievance Redress Procedure

The GRM for the Project will follow a tiered approach, where issues and complaints are initially managed at the local level. Grievances that are complicated or cannot be 'resolved' are escalated. The key stages of the process for the Project are outlined in Figure 8-1. This approach is consistent with other GRM procedures implemented in PNG under World Bank funded projects.

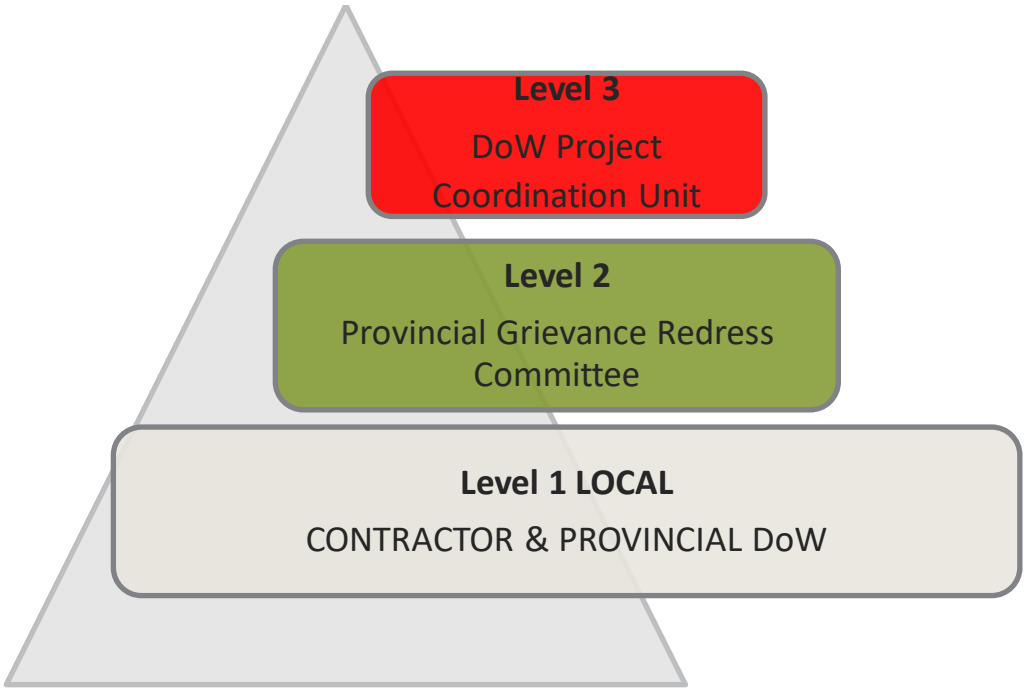

Figure 8-1 Project GRM process

Complainants can submit grievances either orally or in writing. A variety of channels will be established including community representatives, suggestion/complaint box, telephone, SMS, or email. Complaints may be made

anonymously, and confidentiality will be ensured in all instances, including when the person making the complaint is known.

There will be extensive awareness and disclosure to ensure that all stakeholders, including local authorities and community members in the vicinity of the identified works, are informed of the Project 's GRM process.

All complaints or grievances submitted will require the completion of a Grievance Claim Form. Complaints or grievances will be recorded in a Complaints Register held by the DOWH PIU.

The GRM will include details of how reports of GBV, including Sexual Exploitation and Abuse / Sexual Harassment, will be received, resolved, and documented in accordance with the GBV – SEA/SH Action Plan.

Monthly or quarterly reports prepared by DOWH will provide summaries of complaints, types, actions taken, and progress made in terms of resolving pending issues. The reports will draw on information from DOWHs GRM register and information from Contractor / Provincial DOWH reports.

9 Stakeholder Engagement

This section provides a summary of the engagement process throughout the Design, Construction and Operation and Maintenance Phases of the Project. Stakeholder engagement activities proposed for the RT Project are further described in a separate SEP.

DOWH will be responsible for implementing the SEP working with the EPM and Works Contractor. Civil Works Contractors will be responsible for undertaking stakeholder engagement related to site preparation and construction of the specific physical works.

9.1 Stakeholder Engagement Principles

To ensure a best practice approach in stakeholder engagement is delivered, the Project will apply the following principles for stakeholder engagement:

- Openness and life-cycle approach: Public consultations for the Project(s) will be arranged during the whole life cycle, carried out in an open manner, free of external manipulation, interference, coercion, or intimidation.
- Informed participation and feedback: Information will be provided to and widely distributed among all stakeholders in an appropriate format; opportunities will be provided for communicating stakeholders' feedback, for analysing and addressing their comments and concerns.
- Inclusiveness and sensitivity: Stakeholder identification will be undertaken to support inclusive communications and build effective relationships. Equal access to information will be provided to all stakeholders with all impacted stakeholders to be encouraged at all times to be involved in consultation processes. Sensitivity to stakeholders' needs will be the key principle underlying the selection of engagement methods with special attention given to vulnerable groups (people living in poverty, in settlements or outside their traditional communities, remote or inaccessible areas, women, youth, elderly, people with disabilities, those with underlying health issues and culturally diverse ethnic groups).

9.2 Completed Stakeholder Engagement

Stakeholder engagement during Project Preparation has been limited to national representatives. Due to current COVID-19 associated restrictions with public gatherings in PNG, there have been restrictions on engagement activities. A record of consultations and feedback is provided in the project's Stakeholder Engagement Plan.

As noted below there is substantial future stakeholder engagement proposed across all three phases of the Project. These activities will follow the substantial previous engagement undertaken for roadworks on the Ramu and Hiritano Highways over many years involving DOWH with funding from various agencies. Learnings from this earlier engagement will be incorporated into Project stakeholder engagement activities.

9.3 Relevant Stakeholders

For the purpose of effective and tailored engagement, stakeholders of the proposed Project can be divided into the following core categories:

Affected Parties include local communities/community members and other parties that may experience direct impacts from the Project. Specifically, the following individuals and groups fall within this category:

- Local communities in the vicinity of the planned sub-projects including: Clan/village leaders, including leadership from identified ethnic and informal settler groups; Community groups (local churches/youth/ women organisations); Project affected households; Market vendors; Local schools; Local health centres; Working age population

- Road users including motorists (including heavy freight transport/commercial and private); public motor vehicle (PMV) operators; pedestrians
- Government agencies: Conservation and Environment Protection Authority (CEPA); Climate Change Development Authority (CCDA); Road Traffic Authority (RTA); Provincial administration and relevant agencies; and local level government
- Utilities and Business: PNG Power Limited; Water PNG; Ramu Nickle; Ramu Agri Industries Ltd
- Contractors/subcontractors.

Other Interested Parties include individuals/groups/entities that may not experience direct impacts from the Project but who may consider or perceive their interests as being affected by the project and/or who could affect the project and the process of its implementation in some way. Other interest parties for the Projects include: development partners; politicians; other government ministries; industry peak bodies; local and international NGOs; media and the general public.

Vulnerable Groups are those individuals and groups who may find it more difficult to participate and those who may be differentially or disproportionately affected by the project because of their marginalised or vulnerable status. Broad identification of vulnerable stakeholders includes: people living outside their customary land/communities (i.e. informal settlers); people with disabilities; vulnerable road users (i.e. children, elderly, roadside market vendors and anyone using the road not in a vehicle); women and female-headed households.

Vulnerable groups within the communities affected by the Project will be further confirmed during the Project design phase, and consulted through dedicated means, as appropriate.

9.4 Planned Engagement

To ensure a best practice approach in stakeholder engagement is delivered, the Project will apply the principles of meaningful consultations, informed participation and feedback and inclusiveness and sensitivity. All engagement will be undertaken according to the COVID-19 Safety Protocol for Project implementation.

9.4.1 Design Phase

The following stakeholder engagement is planned for the Design phase to be led by DOWH and EPM:

- Meetings with local communities and road users and vulnerable groups supported by public notices
- Correspondence and reporting with key government agencies
- Meetings with utilities and business stakeholders and interested NGOs
- Communication via tender documentation and meetings with contractors and subcontractors.

9.4.2 Construction Phase

The following stakeholder engagement is planned for the Construction phase to be led by DOWH, EPM & Works Contractors:

- Community meetings and public notices, and household meetings as required
- Small group and household meetings as necessary with owners of land and/or assets temporarily acquired during construction
- Small group meetings with vulnerable groups
- Correspondence and reporting with key government agencies

- Meetings with utilities and business stakeholders
- Communication via tender documentation and meetings with contractors and subcontractors.

9.4.3 Operation and Maintenance

The following stakeholder engagement is planned for the Operation and Maintenance phase to be led by DOWH, EPM & Works Contractors:

- Meetings with local communities and road users
- Correspondence and reporting with key government agencies
- Meetings with utilities and business stakeholders
- Progress reporting and meetings with contractors and subcontractors.

9.5 Information Disclosure

All project design documentation, including Environmental and Social Impact Assessments, Resettlement Plans, Environmental and Social Management Plans prepared for road works activities under Component 1 are to be publicly disclosed on the WB website (www.worldbank.org) as well as relevant GoPNG websites. This will be combined with information disclosure via consultation meetings and public notices and signs/noticeboards.

9.6 Stakeholder Engagement Tools and Materials

Stakeholder engagement tools and community relations measures that will be used in conjunction with this SEP include:

- Project Summary Documents – for each key stage of the Project
- Consultation materials
- Use of language appropriate for various stakeholder groups
- Accurate and detailed engagement/meeting notes
- Grievance Redress Mechanism.

Actions for the final ESIA

- **Identify/confirm and provide record of consultation with affected parties at the community level for each sub-project including Ward Members, customary clan/village leaders and representative groups, leaders of settler groups, female leaders and women's groups, and other vulnerable groups.**

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10 Capacity development and training

DOWH has acted as Implementing Agency throughout the 16 years of World Bank-supported roads project implementation in PNG under RMRP and RMRP II. As a result of this long and close involvement, the DOWH management is familiar with the Bank's policies relating to project implementation, and the requirements for implementing agencies to comply with those policies. DOWH's Environmental and Social Safeguards Branch has continued to develop its capacity in recent years. The ESSB offers support to project teams. DOWH also enjoys sustained technical assistance through DFAT's TSSP and ADB support. Additional detail regarding current capacity and the available funding will be included in the Final ESIA.

While E&S management has improved, it remains a key challenge for the project. Issues with E&S capacity and compliance have included delays to engagement and subsequent deployment of key E&S risk management personnel, inadequate monitoring of E&S risk management by the PMU, and poor contractor performance (such as the absence of Contractors' Environmental and Social Management Plans, non-compensation of people affected by the project on roads to be rehabilitated and a contractor fatality).

A capacity building plan for DOWH environmental and social resources will be developed and implemented throughout project implementation period.

Capacity for project delivery will be enhanced through the appointment of an Employer's Project Manager (EPM). The EPM will carry out detailed scoping, preparation of bidding documents, and oversee procurement besides supporting the performance-based contract management unit in DOWH to monitor the construction and long-term maintenance contract(s). The EPM will also be responsible for on-the-job training of DOWH counterparts at its headquarters and in the provinces. The EPM will provide support to DOWH in the Environmental and Social Safeguards duties. The EPM's safeguards specialist would be internationally recruited and would provide on-job training to DOWH locally recruited specialists. The EPM team will provide the technical E&S input to studies required to inform the detailed design works and Final ESIA including, terms of references and technical review, to ensure compliance with local legislation, the World Bank's ESF requirements and good international industry practice.

Actions for the final ESIA

- **Conduct a** capacity assessment and outline a capacity building plan for supporting and developing **DOWH E&S management functions during sub-project design, construction and operation and maintenance.**

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11 Incident management and emergency response

This section summarises the potential incident and emergency situations (such as fires, floods, explosions, spills), how these will be managed and who is responsible.

11.1 Incident Monitoring

An incident is defined as a non-routine specific event, sequence of events, or extended condition that had an unwanted or unintended impact on safety, security, health and/or livelihood of people, property, or the environment, or on legal/regulatory compliance.

Incident management consists of those post incident actions which are performed to ensure the appropriate level of post incident care is provided to the environment and people, address requirements related to good business practices (i.e. notification, understanding corrective actions to prevent recurrence, and liability protection) and ensure regulatory compliance (i.e. notification and reporting).

The contractor is responsible for initiating the incident management. The EPM will provide implementation support and oversight to the Contractor and subcontractor for lower-level incident management to ensure their effectiveness. In cases outside the designated contractor project areas (areas considered to be outside the contract site area), the EPM and/or the Provincial Engineer will initiate incident management.

Project incident management shall be managed according to the following principles:

- Reduce further harm to the community, personnel, the environment, and assets
- Confirm prompt and proper medical care / treatment of injured or ill persons, and perform the appropriate level of follow-up surveillance to ensure injuries and illnesses do not escalate
- Notify and / or report incident details to internal and external stakeholders as appropriate
- Recommend additional steps to remedy the situation and make amends
- Investigate all level 2 & 3 incidents, regardless of the severity level, in order to identify causes and implement corrective actions to prevent incident recurrence
- Stimulate learning opportunities by sharing lessons learned internally and externally as appropriate
- Address potential legal sensitivities and involve legal representatives as required.
- Incident management is comprised of the following key elements, some of which occur concurrently during implementation:
- Secure the area
- Initiate emergency response (if required)
- Perform case management for injuries and illnesses (if required)
- incident classification for higher level by project steering committee made up of Provincial Engineer, EPM and relevant Contractor
- Incident notification
- Incident investigation
- Implement corrective actions such as making amends or changing procedure

- Distribute incident report
- Share lessons learned.

Figure 11-1 below describes the timing and sequential relationships between the key elements of incident management procedures. The contractor shall develop and maintain a system for documenting and tracking incidents, this includes a system that defines categories of incidents so that incidents with social and environmental impacts can be identified. The system will include the details of the incident, identify the remedial / corrective action required, what actual actions were undertaken, assign actions/timings to responsible parties and indicate the status of the remedial / corrective action.

The EPM will monitor progress of the Contractor's lower-level Incident management and its tracking system. The above requirements apply equally to sub-contractors' data which must be included in Contractor's data. An incident report will be submitted in the regular monthly report for all level 2 and 3 Incidents.

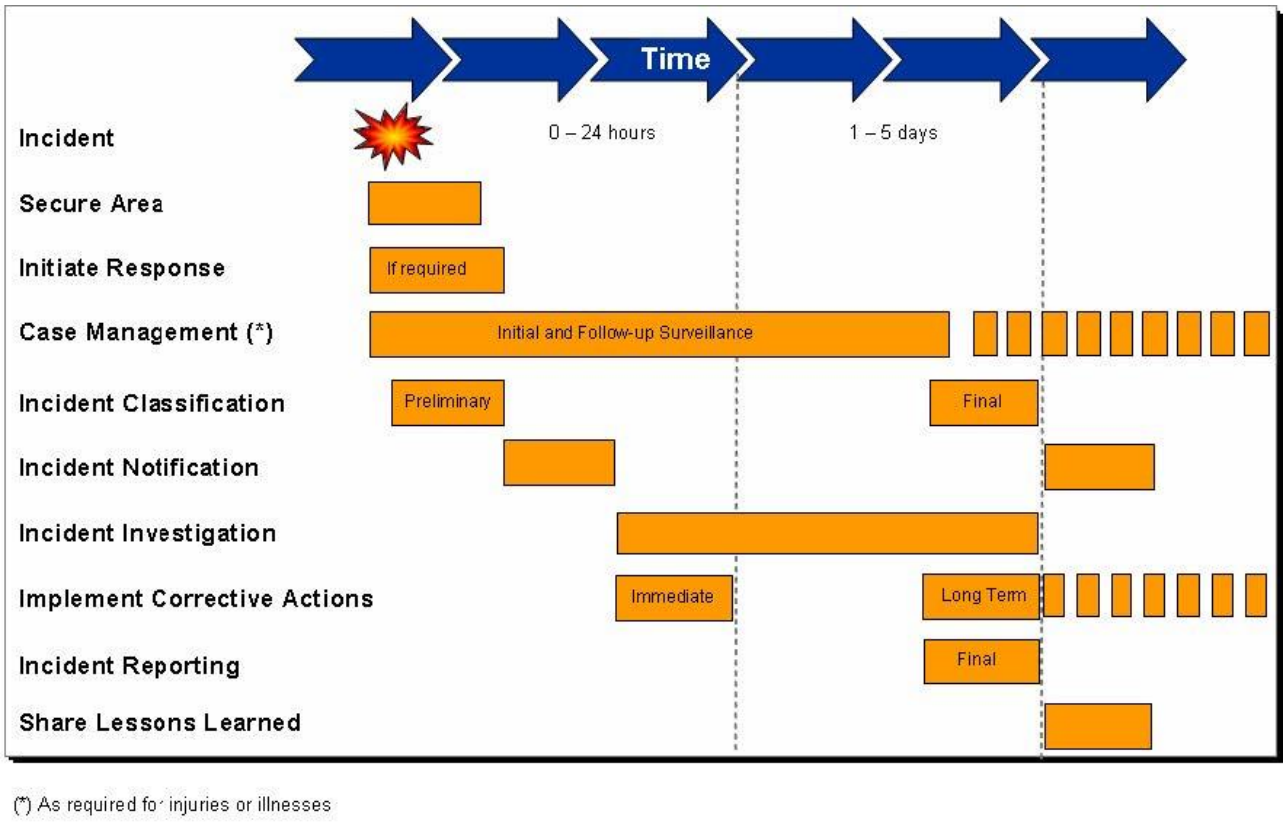

Figure 11-1: Incident Management Procedures by Contractor & EPM for Level 2 and 3

In terms of incident reporting to the World Bank, roles and responsibilities for the Borrower and the Bank are defined in the Environment and Social Incident Response Toolkit (ESIRT). ESIRT establishes which people need to be alerted according to the level of severity of an incident and guidance on providing an effective and appropriate response. World Bank's incident management and reporting process is shown in Figure 11-2. Serious and severe incidents must be reported to the Bank immediately in accordance with the project Finance Agreement. DOWH will then be required to complete a root cause analysis investigation and to develop and implement a corresponding safeguards corrective action plan.

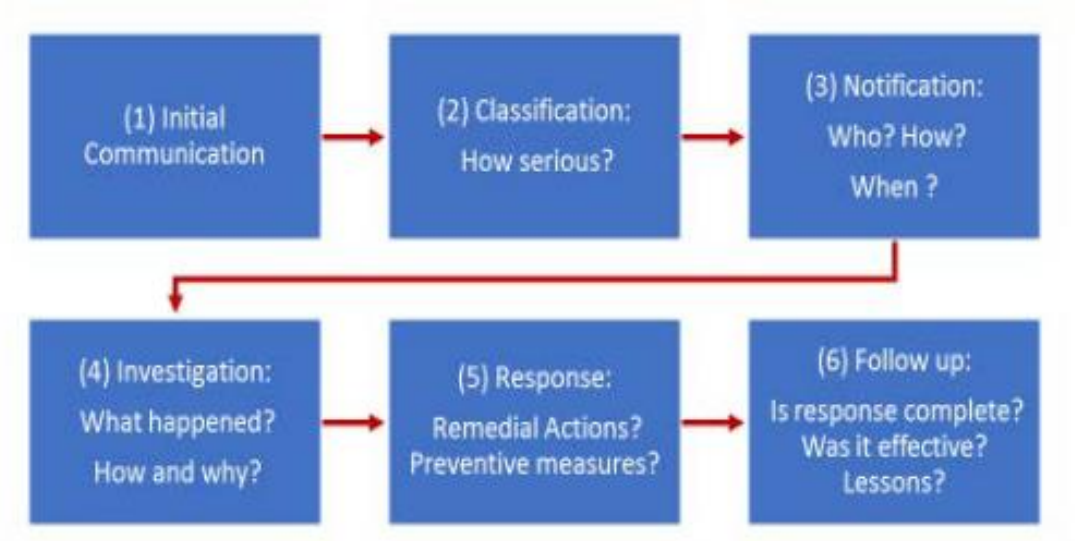

Figure 11-2 ESIRT incident management and reporting process

minor incidents will be covered in routine reporting while significant incidents need to be reported to the World Bank within 24hrs

11.2 Emergency Response

A detailed Emergency Response Plan will be prepared by Contractor (as part of the CESMP). This will cover, as a minimum, incidents such as:

- Containment of hazardous materials, oil and fuel spills
- Accidents
- Vehicle collisions (and vehicle pedestrian collisions) where someone is badly injured or killed
- Uncontrolled blast (relating to drill and blast work if required)
- Landslides
- UXOs
- Other work-related accidents involving severe injury or death.

The ERP will detail the process for immediate notification to PMU, handling, and subsequently, emergencies reporting, and specify the organizational structure (including responsibilities of nominated personnel). The ERP (or CESMP) will include a detailed incident investigation procedure.

The ERP will be submitted to PMU for approval. Implementation of the ERP will be monitored by PMU. Any emergencies, and how they were handled, will be reported in the Contractor's Monthly Progress Report.

12 Implementation Arrangements

The following section describes the arrangements and systems for implementing the ESMP outlined in Section 7.

12.1 Resourcing

The following resourcing, roles and responsibilities are required for the implementation of the ESMP.

- DOWH
  - DOWH PIU including the Project Director, 2 x DOWH E&S Officers
  - DOWH Lands Division including 1 x DOWH Lands Officer
  - Provincial Works Department including 1 x Provincial Engineer and 1 x Community Liaison Officer

  The DOWH PIU will also be supported by DOWH's Environmental and Social Safeguards Branch
- EPM
  - EPM Project Manager, Environmental Specialist, Social Specialist, OHS Specialist and Road Safety Specialist
- Contractor
  - At least 1 x environmental officer (EO), 1 x Occupational Health & Safety Officer (HSO) and 1 x Community Liaison Officer

12.2 Roles and Responsibilities

The DOWH concentrates on supervision and quality control and is also responsible for administering building codes and standards. DOWH implements all projects in accordance with *Environment Act 2000* and the national environmental policies and monitors compliance with prescribed environmental standards.

Table 12-1 outlines the roles of the main stakeholders responsible for the implementation of the ESMP. Figures Figure 12-1 shows the procedural interactions between stakeholders during the conduct of environmental procedures for implementation of the sub project.

Table 12-1 Roles and Responsibilities in E&S Management

DOWH to review and update as needed

Stakeholder	Main role in implementation of the ESMP	Responsibilities						
		Intergovernmental and inter-ministerial co-ordination	**Preparation of CESMP**	**Implementation of mitigations and/or management programs in CESMP**	**Daily/weekly checklists and monthly reporting**	**Supervision/ Quality control/ Enforcement**	**Consultation advice, complaint, feedback**	**Audit quality assurance**
DOWH	Borrower	Overall project coordination implementation					Responsible for resolution of comments and high-level grievances	Input
Employer's Project Manager (EPM/ site supervisor	Project management, supervision, contract management	Support DOWH at meetings	Supervision and coordination of technical quality control	Supervision and coordination of quality control and ensuring that work carried out meets the requirements of the ESF instruments	Responsible for supervision and coordination of quality control and endorsement of monthly reports	Responsible for supervision and coordination of quality control	Coordination	Support implementation of quality assurance audit by DOWH Environment and Social Safeguards Branch (ESSB) to enforce if CEPA constrained by budget or personnel
EPM's safeguards team	Support to EPM	Support to Provincial Works (PWD) at meetings	Coordination of preparation and approval of document	Responsible for supervision	Responsible for supervision	Input and support	Preparation of investigation and feedback on issues, comments and higher-level grievance redress mechanism (GRM)	Provides requested information from site visits
Contractor	Construction	Provides technical support at meetings on request	Responsible for Preparation	Responsible for Implementation, including Contractor's self-monitoring of its	Responsible for preparation	Responsible for Implementation including Contractor's self-monitoring of its	Responsible for resolution of issues, comments and low-level grievances	Provides requested information from site visits

Stakeholder	Main role in implementation of the ESMP	Responsibilities						
		Intergovernmental and inter-ministerial co-ordination	**Preparation of CESMP**	**Implementation of mitigations and/or management programs in CESMP**	**Daily/weekly checklists and monthly reporting**	**Supervision/ Quality control/ Enforcement**	**Consultation advice, complaint, feedback**	**Audit quality assurance**
				environmental and OHS performance to ensure mitigation measures are properly implemented		environmental and OHS performance to ensure mitigation measures are implemented		
Provincial Government	Consultation and advice	Input to technical meetings	Inputs to regular consultation	Inputs to regular consultation	Inputs to regular consultation	Monitors contractor performance through environmental officer if available	Facilitation of feedback to communities	Input
Village communities	Consultation and advice	Provide advice through stakeholder engagement process	Inputs to regular consultation	Inputs to regular consultation	Inputs to regular consultation	Monitors contractor performance	Prepares comments and/or grievances	Input
ESSB/CEPA	Monitoring of Compliance with Quarry Conditions	Responsible for Safeguards Implementation Providing Advice and enforcement	Review of CESMP	Monitoring of Process	Monitoring of Process	Monitoring of Process	Monitoring of Process	Responsible for quality assurance and review and enforcement of CESMP provisions
World Bank	Due Diligence and Monitoring of Safeguard Monitoring Reports	Review of CESMP	Review of CESMP	Monitoring of process	Monitoring of process	Monitoring of process	Monitoring of process	Monitoring of implementation

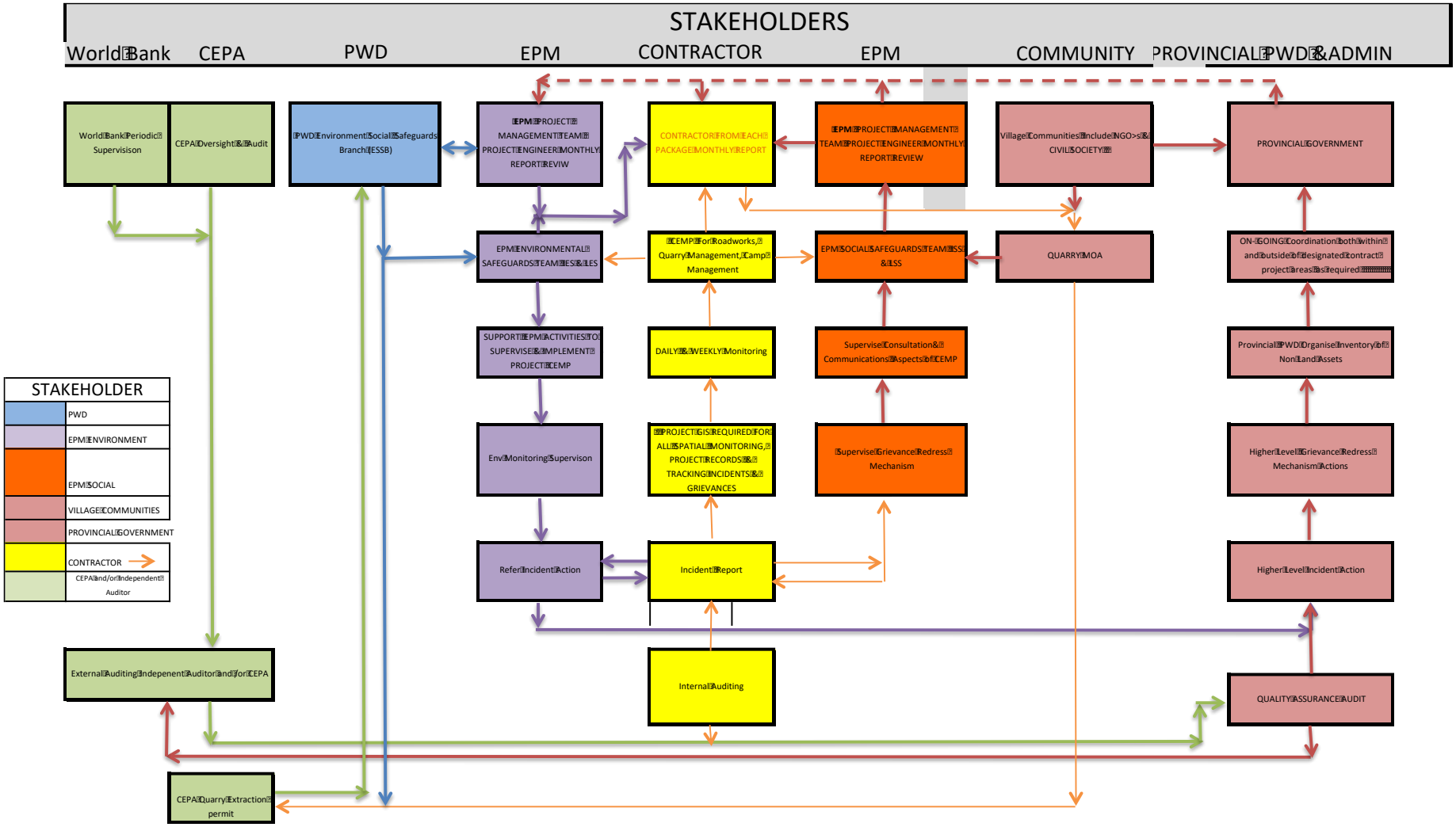

Figure 12-1 Procedural interactions between stakeholders during ESMP implementation.

12.3 Monitoring and Reporting Procedures

Environmental and social monitoring includes:

- Contractual requirements for specific monitoring and reporting;
- Specific monitoring[24] and reporting requirement will be detailed in the CESMP before the commencement of civil work;
- Consultation for core communities and affected persons; and
- Routine site inspections and record inspections.

Non-compliance to E&S mitigation measures identified in the plan will be advised in writing to the Contractor by the Supervising Engineer. The non-compliance notification will identify the problem, including the actions the Contractor needs to take and a timeframe for implementing the corrective action.

E&S monitoring requirements are outlined in Section 7, Table 7-1

12.3.1 Frequency & Coordination with Monthly Reporting Cycle

A monthly report will be issued by the Contractor as contractually required. In order to ensure adequate time to synchronize environmental and social recommendations from EPM to the Contractor, there will be E&S on-site audit/inspections undertaken during the term of the contract including an initial induction meeting during the mobilisation phase of the contract. The inspection will be carried out by the EPM and/or the DOWH E&S personnel with the environment and social (ESO) of the relevant contractor. The ESO will prepare a concise monitoring report which will address routine monitoring compliance using an agreed checklist template as reference. Incident monitoring will also be addressed if and when required. The site visit will allow issues to be explained in the field. Any recommendations for action will then be prepared by EPM so that these recommendations can be issued as instructions at the regular monthly project meeting in accordance with the Contract instructions protocol. The ESO report will be included in the monthly report with the EPM action recommendations.

The EPM is responsible for quarterly reporting to WB. This quarterly progress report will include a section on safeguard compliance and issues. This section will cover:

- Overall compliance with implementation of the Final ESIA;
- Any environmental issues arising as a result of project works and how these issues will be remedied or mitigated;
- OHS Performance;
- Community consultation and communication updates; and
- Summary of complaints or grievances reported, actions taken and status of the actions.

[24] For example, should it be identified that a gravel extraction site will be required for the project, site inspection and test the quality of the water in the river downstream and upstream of the gravel extraction sites shall be undertaken by the Contractor in accordance with the approved CESMP and its sub-plans, to detect any differences in river water quality. The CESPM will include water quality requirements specifying that turbidity shall not exceed [indicative value] Nephelometric Turbidity Units (NTU) and Total Suspended Solids (TSS) shall not be more than [indicative value]mg/l or [percentage percent] increase of the background concentration.

12.3.2 Logistics

For the ESHS meetings on projects which require travel and accommodation, the World Bank Coordinating branch of DOWH, all travel requests by LES/LSS shall be submitted at least three days before the scheduled meeting in order to ensure that the meetings can be carried in accordance with the above schedule.

12.3.3 Joint inspections with other government institutions (e.g. CEPA)

All new quarries producing more than 100,000 Tonnes of material require a quarry permit which is issued by the CEPA. In these cases, CEPA need to visit the site with a representative of the DOWH. The officer can be from either the ESSB and/or the EPM. Once the inspection has taken place a field report on issues arising shall be prepared by both ESSB and EPM within three days and a copy tabled at the next regular safeguards meeting to discuss and agree on any actions required by the Contractor.

For quarries of less than 100,000 tonnes, no quarry permit is required. In this case, the EPM will verify with the contractor that the tonnage will not exceed this limit and will be tabled at the next safeguard meeting so that an instruction can be issued as to the maximum tonnage to be utilized using the Contract instructions protocol at the next normal project meeting.

A quarry management plan (QMP) must be prepared in either case and submitted to the Engineer's Representative and EPM Supervising Engineer for discussion and approval which includes a tabular presentation of all CEPA permit conditions and their compliance status in the case of the quarry requiring a permit (i.e. more than 100,000 tonnes).

12.3.4 Agreed templates for monitoring and reporting

A monitoring checklist will be agreed between EPM and the Individual Contractors. Metrics for E&S reporting will be outlined in the works contracts.

12.3.5 Routine compliance monitoring

The template for routine compliance monitoring is agreed between the Engineer and EPM and included in the final copy of CESMP. The monitoring and any management protocols shall be based on the risk analysis in the CESMP and included in the template so that it can be used for quality control checking by EPM and quality assurance audits by the ESSB and provincial environmental officers. There are different levels of non – compliance which are set out in Table 12-2. The response to a finding of non- compliance shall be proportionate to its level and the contractor will be informed by the EPM and Provincial Engineer based on Non-Conformance Levels.

Table 12-2 Levels of non-compliance

Level	Description	Action required
Field Observation	A potential Non-Conformance situation where an observation intervention, and/or corrective action is required in order to prevent Non-Conformance to a benchmark or standard	Field Observations will generate a corrective action request or a recommendation for further action. A Field Observation that is not closed out in a timely manner or repeat Field Observations may escalate to Non-Conformance
Level I	A Non-Conformance situation not consistent with CESMP requirements, but not believed to involve damage or reasonable expectation of damage to environment or community or individual.	Level I Non- Conformances will generate a corrective action request or a recommendation for further action

Level	Description	Action required
Level II	A non-conformance situation, typically including observed damage or a reasonable expectation of damage to environment or community or individual. Requires expeditious corrective action to prevent occurrence or reoccurrence. Typically aligned in terms of potential consequence with definitions for Severity Level 1 Incidents.	Level II Non -Conformances will generate a corrective action request and a formal Non-Conformance notice. Level II Non-Conformances may result in a Stop Work Order
Level III	A critical Non-Conformance situation, typically including observed significant damage or a reasonable expectation of significant damage to a sensitive environment or community or individual. Requires expeditious corrective action to prevent occurrence or reoccurrence. Typically aligned in terms of potential consequence with definitions for Severity Level 2 and 3 Incidents	Level III Non -Conformances will generate a corrective action request or a recommendation for further action and will result in a Stop Work Order

Note: Non-conformances may, at the EPM Engineer's discretion, be escalated from one level to the next in case of repeated occurrence or lack of corrective action

12.3.6 Incident Notification, Management and Reporting

Incident notification, management and reporting requirements are outlined in Section 11.

12.3.7 Grievance Management and Reporting

Grievance management and reporting requirements are outlined in Section 8.

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PCR Chance Find Procedures

In accordance with ESS8 and the National Cultural Property (Preservation Act) 1965, person working on the project discovers a cultural heritage site or item the following procedures shall be followed:

1. Stop the activities in the area of the chance find;

2. Delineate the discovered site or area (e.g. fencing);

3. Secure the site to prevent any further disturbance, damage or loss. In cases of human remains, arrange for a guard to watch the site until the police, local government and / or National Cultural Commission representative or person with delegated authority take over;

4. Prohibit the collection of objects by any person;

5. Notify the local government and National Cultural Commission within 24 hours (and police if it is human remains);

6. Any objects that are found must be handed over to the National Cultural Commission.

7. Project works can resume only after instruction is provided from the National Cultural Commission.

Note that Section 9 (1) of the National Cultural Property (Preservation) Act, 1965, states 'A person who, without lawful and reasonable excuse (proof of which is on him) wilfully destroys, damages or defaces any national cultural property, is guilty of an offence. Penalty: A fine not exceeding K200.00.'

Sexual Exploitation and Abuse / Sexual Harassment Action Plan

Papua New Guinea Resilient Transport Project (RTP)

Sexual Exploitation and Abuse (SEA) and Sexual Harassment (SH) Action Plan

1. BACKGROUND

This SEA and SH Action Plan outlines the strategies that RTP will adopt to mitigate and respond to risks of SEA / SH related to the project in line with the World Bank's *Good Practice Note Addressing SEA and SH in Investment project Financing Involving Major Civil Works*[25].

The project was assessed as 'moderate' risk using the World Bank's SEA / SH Risk Screening Tool.

Component 1 of RTP includes improvements and maintenance of Ramu Highway, Madang and Morobe provinces, and Hiratano Highway, Gulf and Central provinces. The project also has a focus on empowerment of women, especially those living in the influence areas of the two project roads. The project will explore opportunities to directly contribute to the increase of women's labor force participation for routine road maintenance and a higher participation of female workforce within DOWHI.

2. Gender-based violence (GBV) expertise

The Supervising Engineer will appoint a GBV specialist who will support the implementation of their Action Plan and ensure adherence to World Bank SEA / SH risk mitigation and response strategies.

3. Risk mitigation (prevention)

SEA and SH

Procurement

Bidders will be directed to the specific SEA/SH requirements of the project.

Code of conduct

A code of conduct, that explicitly prohibits SEA and SH, will be signed by all employees of contractors (including sub-contractors), supervising Engineers and other consultants to indicate that they have:

- Received a copy of the code of conduct;
- Had the code of conduct explained to them;
- Acknowledged that adherence to the code of conduct is a condition of employment; and
- Understood that violations of the code of conduct can result in serious consequences, up to and including dismissal.

The Codes of Conduct will be available in English, Tok Pisin or Motu, and any language of foreign project employees.

Code of conduct induction

All employees of contractors (including sub-contractors), supervising Engineers and other consultants will attend an induction session on:

[25] World Bank, 2020. Good Practice Note: Addressing Sexual Exploitation and Abuse and Sexual Harassment in Investment Project Financing involving Major Civil Works. World Bank: Washington, United States of America.

- The SEA / SH components of the code of conduct, and what constitutes a violation of the code of conduct to set clear expectations of behavior.
- What may happen if they use SEA or SH in violation of the code of conduct.
- How to report SEA or SH / a violation of the code of conduct.
- What local specialist GBV service providers are available to survivors and how to contact them.

Community awareness-raising

Awareness-raising activities for the whole community, ensuring the participation of women, women and men with disabilities, and other groups in the community who are more likely to experience SEA or SH, will be conducted primarily by the GBV service provider.

At a minimum, awareness-raising will increase beneficiaries and communities understandings of:

- The SEA and SH components of the code of conduct, and what constitutes a violation of the code of conduct.
- How to report SEA or SH / a violation of the code of conduct.
- What local specialist GBV service providers are available to survivors and how to contact them.
- What to expect when making a complaint of SEA or SH to the project.
- The limitations of the grievance mechanism in relation to complaints GBV.

GBV service provider

The contractor will engage a GBV service provider who will conduct the project worker induction on the SEA and SH components of the code of conduct and the community awareness-raising on the SEA and SH components of the code of conduct.

The facilitators of the induction and community awareness will have:

- An understanding of the gendered nature of GBV.
- An understanding of the context of GBV in Papua New Guinea.
- Experience delivering training on GBV from a survivor-centered approach.
- Experience upholding and advocating for women's rights and gender equality.
- Experience responding to disclosures of GBV and adhering to a survivor-centered approach.
- At least one woman facilitator in the team.

Domestic violence and other forms of GBV

RTP include will integrate project strategies which prevent possible resistance and backlash from men to women's increase employment and empowerment. This will include increasing the support for women's employment in the traditionally male dominated sectors of road maintenance and within DOWHI with men within those workplaces and in the communities where women will be encouraged to take on road maintenance roles. Such strategies will support broader effort toward gender equality by focusing on increasing men's support for women's empowerment, including women's access and control over resources and decision-making relating to their income.

4. Risk response

Referral to specialist GBV service providers

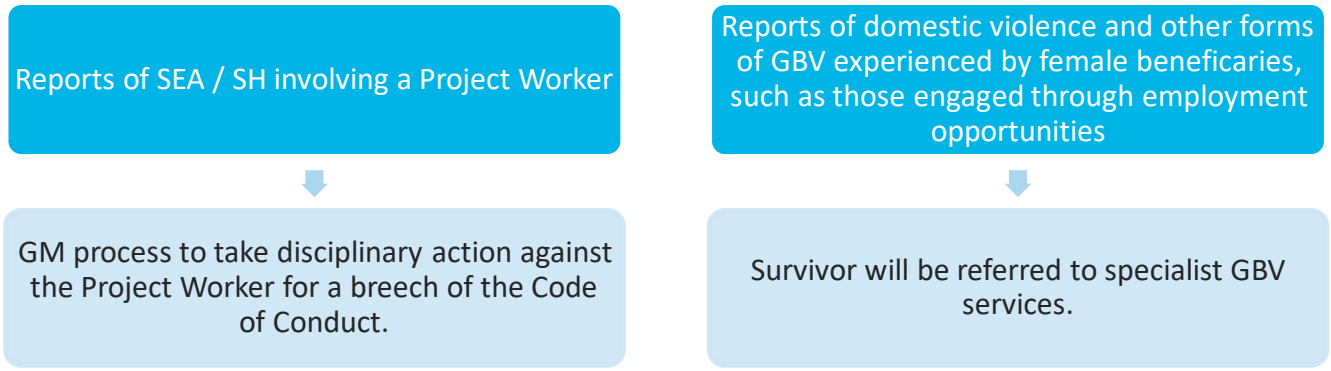
For each project site, a list of specialists GBV service providers will be developed to enable the project to refer any survivors of GBV to services immediately.

For locations where there are limited or no specialist GBV service providers, the project will ensure that there is funding available to transport survivors to specialist GBV service providers in the case of SEA or SH related to the project.

In addition, women who are engaged through the employment opportunities will also be provided about the closest specialist GBV support services (police, health, counseling, safe accommodation). Where possible, the local specialist GBV service, will conduct an awareness session with women who are engaged through the employment opportunities on their right not to experience violence and how to access social and legal GBV services.

Grievance mechanism (GM)

The project GM will include details of how reports of GBV, including SEA / SH, will be received, resolved, and documented. The following elements will be integrated into the GM to respond to cases of GBV, including SEA / SH:



The following elements will be integrated into the GM to respond to complaints of SEA / SH involving a project worker:

Principles	**The process to receive and respond to complaints of GBV, including SEA / SH, will apply a survivor-centered approach to ensure that the rights of the survivor are upheld. This includes ensuring the survivor's safety, choice, consent and confidentiality and to ensure that the survivor is informed, respected and referred to specialist GBV services.** **The process will also be accessible, transparent, timely and fair.**
Receiving complaints of GBV, including SEA / SH	The GM must be accessible to survivors of GBV, including SEA / SH. This means: - Having multiple reporting methods and contacts including at least one woman who can receive complaints for each Project Site. - Outlining how third-party reports will be responded to. - Having a referral pathway for each Project Site to refer any survivors to the closest specialist GBV service providers. - Increasing the awareness of communities that will interact with project workers on how to access the GM.

Resolving complaints of GBV, including SEA / SH	The GM should include a clear process to resolve the complaints of GBV, including SEA / SH, which is survivor-centered. This includes processes to:
	- Assess if the allegation is likely linked to the RPT.
	- Verify the allegation to:
	  ○ Determine the likelihood that the incident occurred.
	  ○ Recommend disciplinary measures toward the alleged perpetrator.
	- Ensure the survivor can speak to one person through the process, in most cases the contact person should be a woman.
	The GM will also clearly articulate that reports of GBV will not be resolved using customary practices of conflict resolutions, such of medication and compensation.

Recording complaints	The GM will outline how information of reports of GBV, and actions taken to resolve the complaint, will be collected and stored confidentiality and ensure the information is not shared outside necessary reporting requirements

of GBV, including SEA / SH	The GM will also include details of required notification to the World Bank Task Team with only the following data to be shared: - The nature of the allegation. - If the alleged perpetrator is, to the survivor's best knowledge, associated with the Project (yes/no). - The survivor's age and/or sex (if available). - If the survivor was referred to services.
Training	Anyone receiving or handling complaints of GBV must receive training so that they do not revictimize and retraumatize survivors or unintentionally cause them harm. Those who have been identified to receive complaints of GBV will complete training to: - Understand the gendered nature of SEA and SH, the GBV requirements in the code of conduct and the GBV pathway in the GM. - Have the skills to receive complaints of GBV. Those tasked with resolving incidents of SEA / SH will also complete training to develop their skills to receive, resolve and record complaints of GBV.

Implementation and monitoring plan

Activity	Responsible	Oversight	Status	
			Ramu Highway	Hiratano Highway
1. Risk mitigation (prevention)				
1.1. Procurement				
The contractor has provided the DOWHI with a proposed approach to implementing the SEA/SH Action Plan in the C-EMSP.	Contractor.	DOWHI.		
1.2. Code of conduct				
The contractor has provided the DOWHI with the code of conduct which explicitly prohibits SEA and SH.	Contractor.	DOWHI.		
The code of conduct has been signed by all employees of contractors.	Contractor.	DOWHI.		
1.3. Code of conduct Induction				
GBV training providers identified and engaged to provide project worker induction and community awareness training.	Contractor	DOWHI.		
All project workers have attended an induction session on the code of conduct.	Contractor (to recruit GBV service provider to conduct).	DOWHI.		
1.4. Community awareness-raising				
Awareness-raising activities for the affected community(ies) on the code of conduct.	Contractor (to recruit GBV service provider to conduct).	DOWHI.		
Conduct awareness with men within workplaces where women will be employed through the project and in the communities where women will be encouraged to take on road maintenance roles to increase men's support for women's empowerment.	DOWHI.	World Bank.		
2. Risk response				
2.1. Referral to specialist GBV service providers				
Develop list of specialists GBV service providers.	DOWHI.	World Bank.		
For locations where there are limited or no specialist GBV service providers, ensure that there is funding available to transport survivors to specialist GBV	DOWHI.	World Bank.		

Activity	Responsible	Oversight	Status	
			Ramu Highway	Hiratano Highway
service providers in the case of SEA or SH related to the project.				
Provide information on GBV support services to women who are engaged through the employment opportunities.	DOWHI.	World Bank.		
2.2. Grievance mechanism				
The project GM includes a pathway for receiving complaints of SEA / SH.	DOWHI.	World Bank.		
Appoint person(s) responsible for receiving and managing SEA and SH complaints.	Implementing Agency & Contractors.	World Bank.		
Train person(s) responsible for receiving and managing SEA and SH complaints on handling SEA and SH complaints.	DOWHI.	World Bank.		

Red List Species, Ramu Highway

SUMMARY OF IUCN RED LIST DATA FOR PROJECT AREA

Enter your search term

Family	Species	Common Name	IUCN Status
		New Guinea Quoll, New Guinean Quoll	NT
Hipposideridae	*Hipposideros muschinus*	Fly River Leaf-nosed Bat, Fly River Roundleaf Bat	DD
	Hipposideros semoni	Semon's Leaf-nosed Bat, Semon's Roundleaf Bat	DD
Macropodidae	*Dendrolagus goodfellowi*	Goodfellow's Tree Kangaroo, Ornate Tree-kangaroo	EN
	Dendrolagus matschiei	Huon Tree Kangaroo, Matschie's Tree-kangaroo	EN
	Dendrolagus notatus	Ifola tree-kangaroo	EN
	Dorcopsulus vanheurni	Small Dorcopsis, Lesser Forest Wallaby, Small Dorcopsulus	NT
	Thylogale browni	New Guinea Pademelon	VU
	Thylogale lanatus	Mountain Pademelon	EN
Molossidae	*Otomops secundus*	Mantled Free-tailed Bat, Mantled Mastiff Bat	DD
Muridae	*Microhydromys richardsoni*	Groove-toothed Shrew Mouse	DD
Phalangeridae	*Spilocuscus rufoniger*	Black-spotted Cuscus	CR
Pseudocheiridae	*Pseudochirops corinnae*	Plush-coated Ringtail, Golden Ringtail Possum	NT
Pteropodidae	*Nyctimene draconilla*	Lesser Tube-nosed Bat, Dragon Tube-nosed Fruit Bat, Dragon Tube-nosed Bat	DD
Tachyglossidae	*Zaglossus bartoni*	Eastern Long-beaked Echidna	CR
Vespertilionidae	*Miniopterus macrocneme*	Small Melanesian Bent-winged Bat	DD
	Nyctophilus microdon	Small-toothed Long-eared Bat, Small-toothed Bat	DD
Amphibians			
Hylidae	*Litoria contrastens*	-	DD
Microhylidae	*Austrochaperina archboldi*	-	DD
	Choerophryne siegfriedi	-	CR
	Cophixalus nubicola	-	VU
	Liophryne allisoni	-	DD
	Mantophryne infulata	-	DD

Key to IUCN Statuses:

CR = Critically Endangered

E = Endangered

VU = Vulnerable

N = Near Threatened

DD = Data Deficient

CERC ESMF

CERC Procedures

Disbursement of emergency financing under the CERC will be contingent upon: a) the recipient establishing a link between the disaster event and the need to access funds to support recovery and reconstruction activities (an "eligible event"); and b) submission to and no objection granted by the WB of an Action Plan of Activities. The Action Plan of Activities will include a list of activities, procurement methodology and E&S management procedures.

The Action Plan of Activities to be prepared following a disaster event will require consideration of E&S implications for any proposed emergency supplies procurement or reconstruction activities. The WB, through the no objection process, will closely examine the nature of the proposed activities, particularly those involving civil works, to ensure (i) that they are not on the ineligibility list and (ii) that the recipient is aware of the required compliance documentation before initiating the process by which the proposed works will be prepared and implemented.

Preparation of the Action Plan of Activities will have regard to this ESMF and ESS requirements and will require WB approval prior to commencement of activities. The Action Plan of Activities will need to include:

- Procedures for consultation and disclosure,
- Integration of mitigation measures and performance standards into contracts and
- Supervision/monitoring and reporting of measures to ensure compliance.

Aims and Objectives

Main objectives of this CERC screening procedure is to guide the DOWH to conduct environment and social (E&S) screening and subsequent assessment of Project activities during implementation, including any relevant management Plans that have to be developed in compliance with the WB's Environmental and Social Framework.

Specifically, the procedure aims to:

- assess the potential E&S risks and impacts of the proposed Project (both positive or negative), and propose mitigation measures which will effectively address these risks/impacts
- to establish clear procedures for the E&S planning, review, approval, and implementation of activities/subprojects, technical assistance (TA), and other activities to be financed under the Project
- to describe specific mechanisms for public consultation and disclosure of E&S documents as well as redress of possible grievances
- to specify roles and responsibilities of agencies responsible for implementation of the proposed E&S measures including identification of priority training, capacity building, and technical assistance, and the ESMF budget.

The scope of the procedure includes an E&S screening to determine eligibility and activities with E&S risks and identify potential E&S issues and specific Management Plans to be prepared and submitted for WB clearance and/or GOT approval as needed. This annex will be updated to include a full CERC Environmental and Social management Framework prior to the approval of the Final ESIA.

E&S Screening

Each activity within the CERC EAP will require E&S screening. This process should consider the WB eligible and ineligible list of activities (refer ESCP) that can be financed.

Based on the screening, DOWH will:

- ensure that the activities in the "ineligible list" will not be financed by the Project
- sign the E&S screening form

- prepare and implement the specific Environmental and Social Assessment as needed.

Institutional Arrangements

DOWH will be responsible for the oversight, coordination and implementation of this ESMF. DOWH will be supported by the Employers Project Manager.

ESMF Implementation. DOWH/EPM is responsible for coordination and implementation of the CERC EAP in close collaboration and coordination with relevant GoPNG ministries. DOWH/EPM will ensure that activities comply with the CERC ESMF, and any other specific E&S instruments as described in this ESMF.

Monitoring and Reporting (M&R). ESMF monitoring, supervision, and reporting is an integral part of the Project implementation. DOWH/EPM will be responsible for coordinating training the of the Environmental Health and Safety staff of DOWH to be able to do M&R.

Consultation and information disclosure. Consultation and information disclosure are considered part of the implementation and M&R process, as it is a way to reporting back to stakeholder groups. DOWH/EPM will be responsible for consultation and information disclosure regarding the CERC.

CERC E&S Screening Form

Subproject/Activity Name	
Subproject Location	
Subproject Proponent	
Estimated Investment	
Start/Completion Date	

Questions	Answer		ESS relevance	Due diligence / Actions
	Yes	no		
Does the subproject involve civil works?			ESS1	ESIA/ESMP, SEP, GRM LMP
Does the subproject/activity have high levels of environmental risk			ESS1	If yes – Not eligible
Is the subproject/activity expected to cause long term, permanent and/or irreversible (e.g. loss of major natural habitat) adverse impacts			ESS1	If yes – Not eligible
Does the subproject/activity have a high probability of causing serious adverse effects to human health and/or the environment			ESS1	If yes – Not eligible
Does the subproject/activity have high levels of social risk;			ESS1	If yes – Not eligible
Does the subproject/activity involve land acquisition and/or restrictions on land use?			ESS5	RP and SEP
Does the subproject/activity affect economic assets and livelihoods			ESS5	RP and SEP
Does the subproject/activity involve significant physical relocation or economic displacement			ESS5	If yes – Not eligible

Does the subproject/activity involve recruitment of workers including direct, contracted, primary supply, and/or community workers?			ESS2	LMP
Does the subproject/activity present OHS risks to workers				ESIA/ESMP and LMP
Does the subproject have a GM in place, to which all workers have access, designed to respond quickly and effectively?				Project GRM
Is the subproject located within or near any ecologically sensitive areas?			ESS6	ESIA/ESMP, SEP (potentially ineligible)
Is the subproject located within or near any known cultural heritage sites?			ESS8	ESIA/ESMP, SEP (potentially ineligible)
Does the project area present considerable Gender-Based Violence (GBV) and Sexual Exploitation and Abuse (SEA) risk?			ESS1	SEA/SH prevention measures

Conclusions:

1. **Proposed Environmental and Social Risk Ratings (High, Substantial, Moderate or Low). Provide Justifications.**

2. **Proposed E&S Management Plans/ Instruments.**

Sign by Subproject/activities owner: ……
Position: ……Date ……..

Sign by: ……

Position: ……Date:……