



FRIEDA RIVER

Frieda River Limited
Sepik Development Project
Environmental Impact Statement
Chapter 9 – Socio-Economic Impact Assessment

SDP-6-G-00-01-T-084-011



9. SOCIO-ECONOMIC IMPACT ASSESSMENT

This chapter summarises the results of the Social Impact Assessment (SIA) undertaken for the Project, and draws upon the results, where relevant, of the Economic Impact Assessment (ACIL Allen, 2018) undertaken for the Project Feasibility Study. The purpose of the SIA is to assist decision-makers and Project stakeholders to determine whether the changes that the Project would bring to the social environment are able to be managed.

The objectives of the SIA were to:

- Describe the socio-economic characteristics of the region including the existing land and natural resource use of the Project area.
- Identify the socio-economic factors that may pose constraints in terms of the siting of Project facilities and/or which may otherwise require management.
- Identify the potential negative socio-economic risks associated with the Project and develop methods for managing these risks.
- Identify the potential positive socio-economic benefits resulting from the Project and develop strategies for maximising those benefits, primarily for Project-affected stakeholders.
- Provide an assessment of residual socio-economic risk following the application of mitigation and management measures.

The SIA incorporates the findings of the following specialist technical studies, in addition to the findings of the EIS:

- Cultural Heritage Baseline and Impact Assessment (Appendix 13.2).
- Baseline Health, Diet and Nutrition Survey (Appendix 13.3).
- Health Impact Assessment (Appendix 13.4).

The full SIA is provided as Appendix 13. Information presented in this chapter is sourced from the SIA unless otherwise referenced.

9.1 Approach to Impact Assessment

This section describes the SIA method which was developed in consideration of the:

- CEPA Draft Social Impact Assessment Guideline (DEC, undated).
- International Principles for Social Impact Assessment (IAIA, 2003; Vanclay et al., 2015).
- International Finance Corporation's (IFC) Good Practice Note, Addressing the Social Dimensions of Private Sector Projects (IFC, 2003).
- IFC Performance Standards on Social and Environmental Sustainability (IFC, 2012a).

The International Principles for Social Impact Assessment (IAIA, 2003) defines SIA as being 'the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions'. It considers that 'good practice SIA' involves four phases (Vanclay et al., 2015):

- 1) Understanding issues.
- 2) Predicting, analysing and assessing likely impact pathways.
- 3) Developing and implementing management strategies.
- 4) Designing and implementing monitoring programs.

These phases are embodied in the five-step process used to undertake this SIA, listed below with the corresponding International Association of Impact Assessment phase shown in brackets.

- Scoping, baseline studies and identification of social values (1).
- Impact identification (2).
- Consideration of positive Project effects (2).
- Impact assessment (2).
- Management measures and residual impact assessment (3).

Monitoring and reviewing the effectiveness of management measures (4) is an on-going process implemented by the project developer post submission and approval of the EIS, in the project implementation phase.

This process is described in detail in the following sections.

9.1.1 Scoping, Baseline Studies and Identification of Social Values

Scoping

The PNG Guideline for Preparation of an Environmental Inception Report (DEC, 2004a) stipulates that socio-economic impacts be differentiated into two distinct groups (Group A and Group B) to clearly distinguish the impacts that will occur as either a direct or indirect result of the project development. As described in DEC (2004a):

Group (A) impacts are those that can be identified and addressed by the DEC approval process. They arise directly from adverse impacts upon the biophysical environment as caused by the development.

Group (B) impacts are secondary [indirect] effects that are reasonably expected to manifest themselves [which can be attributed to the Project] and are normally best handled by the responsible National, Provincial or Local Level Government agencies.

The social aspect of the EIR was informed by various baseline social and land investigation studies conducted by FRL and previous proponents. The results of the EIR formed part of the scoping phase of the SIA as it:

- Identified the potential environmental and social issues associated with developing the Project.
- Described the scope of the EIS (and as part of it, the SIA) to address those issues.
- Initiated the formal process of stakeholder consultation.
- Enabled CEPA to review the proposed EIS (and as part of it, the SIA) scope and provide input.

Table 9.1 outlines the main potential socio-economic impacts that were identified in the EIR, presented in the order in which they are listed in the EIR.

Table 9.1 Socio-economic potential impacts identified in the 2017 EIR

Potential Impact
Group A Potential Impacts (Direct)
Physical and economic displacement of villages due to the development of the FRHEP.
Loss of land due to the establishment of Project components and consequent impacts on livelihoods due to loss of resources such as alluvial gold areas, gardens and hunting and gathering areas.
Health impacts on residents in downstream villages, associated with the uptake of contaminant metals from discharged surface water and fugitive sediment associated with the Project.
Reduced amenity from reduction in air quality, increased noise and visual impact and associated consequences on quality of life for affected people.
Loss of or damage to archaeological or cultural sites and practices.
Increased direct employment and training opportunities for employees, landowners and other affected communities.
Improved road access for villages between the mine site and Vanimo.
Increased incomes from employment and other benefit streams.
Generation of new business opportunities to directly service the Project, with consequential increased local incomes.
Effects on the general quality of life of local villagers and those living downstream from the FRCGP, with particular focus on their livelihoods, subsistence resource use, river use, income derivation, and local culture and customs.
Group B Potential Impacts (Indirect)
Increased government revenue from taxes, fees and other payments.
Increased in-migration and associated potential impacts on social cohesion, safety and security, health, land use, services, infrastructure and accommodation.
Increased law and order issues resulting from migration, increased mobility and altered social structures and relationships.
Increased incidence and spread of communicable diseases including HIV/AIDS.
Regional and local electrification arising from FRHEP commercial power distribution and sale.
Large scale renewable power generation from the FRHEP.
Ongoing generation of human, as well as financial, capital, which may underpin further economic and social development in PNG.
Continuity within the PNG mining sector and with it the maintenance of expertise, on which PNG's future mining industry depends.
Indirect stimulation of PNG's economic sectors that drive local, provincial and national economic growth.
Improved national balance of trade, infrastructure development and commercial, employment and educational opportunities.

Baseline Studies

The baseline assessment defines a meaningful basis of analysis to characterise which groups of people, in which locations, will potentially be subject to particular types of impact. In this SIA these areas of influence have been termed 'social catchments'¹ and have been broadly defined through consideration of: community location (including watershed boundaries, and proximity to the Project's footprint and likely mining lease boundaries); the type of Project activity that may occur

¹ Hugo, G. Smailes, P. Macgregor, C. Fenton, M. and Brunckhorst, D. Defining Social Catchments in Non-metropolitan Australia, Bureau of Rural Science, Australia, 2001.

in proximity to villages in the social catchment; and language group or cultural affinity of the villages in the catchment. Social catchments for the Project are defined in Section 7.3.1.

Baseline information was generated through the collection of primary data by way of field surveys, review of relevant studies previously completed for the Project and a review of broader secondary source documentation. The timing and extent of socio-economic baseline studies undertaken throughout the social catchments is detailed in Section 7.3.3.

Identification of Social Values

As set out in Section 7.3.2, social values are qualities of the social environment that are conducive to individual well-being now and into the future, and for which community stakeholders have a high regard.

The six social values that form the basis of the impact assessment are outlined in Table 9.2 and discussed in detail in Section 7.3.2.

Table 9.2 Project area social values

Category 1 - Livelihoods		Category 2 - Culture		Category 3 - Personal and community well-being	
SV1	SV2	SV3	SV4	SV5	SV6
The capacity to support subsistence livelihoods	Opportunities for participation in the cash economy	An enduring ability to sustain individual and group cultural identity and traditions including connection to ancestors	An enduring ability to maintain customary rights to land access and resource use	An environment amenable to personal and family health, education, safety and security	The availability of services supportive of personal health, education, safety and security

The six social values are based on discussions with FRL community affairs staff that have a long experience working with Project area villages, consultation with PNG resource sector community affairs practitioners, and dialogue with mine area social catchment village leaders between 2014 and 2017. It is important to note that social values can change, and may do so rapidly, as key local stakeholders in the Project have themselves initiated quite radical change (and presently continue to experience the consequences of such change) in relatively recent times (see in particular Jorgensen (1990) and Hyndman (1995)).

9.1.2 Impact Identification

Impact identification involved close examination of:

- The Project description (location of Project elements for the FRCGP, FRHEP, SPGP and SIP).
- Proposed approaches to construction (which typically involves an intense period of activity using large numbers of workers living in camps close to work sites).
- Operations (which involves a smaller number of workers focussed on the mine, FRHEP and other Project components, and regular logistics activities to import Project supplies and export product).

The construction and operational experience of projects in similar environments has been considered, as well as the findings of specialist studies that have been undertaken for this Project EIS, such as cultural heritage, water and air quality assessments, terrestrial and aquatic ecology assessments, human health and ecological impact assessments. The experience of other mining developments, both in PNG and globally, highlights the importance of considering downstream effects due to Project related discharges to waterways during construction and operations. The general absence of compensation to downstream communities due to the lack of direct ground disturbance impact, combined with a heightened level of anxiety concerning the integrity of the aquatic environment which is highly important for subsistence livelihoods, elevates the issue to a high level of concern.

An understanding of community aspirations and attitudes to development in general, and the proposed Project in particular, is also an essential input into the identification of potential impacts. The degree of community confidence to embrace and manage risk in the quest for development has a bearing on the experience of impact. In this respect an equally important step at this stage is the identification of potential opportunities for the enhancement of social values, as these can offset impacts on the values, or improve the status of the value above its current state. As stated by Gardner (1996a), the low level of access to services for the population in the Project area, and the awareness of services available in other areas of the country, means that 'people have a keen sense of deprivation relative to other areas of the country'. As well, the long period of mineral exploration at Frieda River has already induced significant impact on the cultures of the area. Knowledge of aspirations and attitudes was gained by direct consultation by means of household surveys, women's focus group discussions, and village leader workshops on social values in 2015. Information on attitudes to development was also available from consultation that occurred in 2010, enabling an assessment of change that may have occurred over the intervening period.

9.1.3 Positive Project Effects

As the Project is a regional development project, rather than a stand-alone mining project, the identified Project impacts often have associated opportunities and positive Project effects. For example, the negative impacts of the public road development, such as reduced amenity, have been considered in the context of positive effects of the new road (i.e., the road will also provide access to villages and markets that would not otherwise be possible in such a remote part of PNG). Positive Project effects that will likely enhance social values were identified by drawing on the experience of similar projects, the characteristics of the proposed Project, and the aspirations of community members and other stakeholders. The identified positive Project effects were not further assessed using the matrix method described in Section 9.1.4 as enabling action, such as the continued maintenance of a public road, is often not within the control of the Project proponent. However, opportunities associated with positive Project effects are discussed in Sections 9.2 and 9.3.

9.1.4 Impact Assessment

A risk assessment approach was used to evaluate the potential impacts on social values, by consideration of the likelihood of the potential impact occurring and the consequential effect if it was to occur (Table 9.3 and Table 9.4). Criteria used for the definition of likelihood and consequence levels, shown in Table 9.5 and Table 9.6, were established in consideration of Australian/New Zealand ISO 31000:2009 Risk management – Guidelines (AS/NZS, 2009). The establishment of likelihood and consequence levels for impacts was undertaken in a workshop comprising persons familiar with the social impact assessment of mining in PNG, with direct experience in engaging with residents of the Project area and with an appreciation of community attitudes, development needs and aspirations.

Table 9.3 Significance assessment matrix

Consequence	Likelihood				
	Almost Certain	Likely	Possible	Unlikely	Rare
Critical	Very high	Very high	High	High	Medium
Major	Very high	High	High	Medium	Medium
Moderate	High	Medium	Medium	Medium	Low
Minor	Medium	Medium	Low	Low	Very low
Negligible	Medium	Low	Low	Very low	Very low

Table 9.4 Significance category definitions

Significance category	Definition
Very high	Likely for irreversible and widespread impairment of a social value to occur, having major consequences for well-being of the majority of community. Extensive support and capacity-building is required to manage change.
High	Possibility for substantial impairment of a social value for a large number of persons with limited capacity to adapt to change. Considerable support and capacity-building required to manage change.
Medium	Possibility for impairment of a social value to some extent with an effect on the well-being of a limited number of persons who will require support to manage change.
Low	Possibility for impairment of a social value that may have minimal effect on individual and community well-being. Support may be required only for vulnerable members of the community.
Very low	Unlikely to be an impairment of a social value and requires no support for individual or community management of change.

Table 9.5 Likelihood criteria

Likelihood level	Definition
Almost certain	Common, often occurs in similar environments or expected to occur in most circumstances.
Likely	Has occurred in recent history; likely to have occurred in similar environments, or will probably occur in most circumstances.
Possible	Has occurred in the past, but not common. The event could occur.
Unlikely	Not likely or uncommon; event is not expected, and is seen as unusual.
Rare	Practically impossible; the event is unlikely to have occurred elsewhere, and will only occur under exceptional circumstances.

Table 9.6 Consequence criteria

Consequence level	Definition
Critical	The impact will affect the value and substantially deteriorate the people's wellbeing. Significant support and capacity building will be required to manage the adverse impacts, and compensation and resettlement may be required for unavoidable impacts. Long-term health effect; wide-spread (regional); fatality(ies); serious injury/ illness requiring extensive medical treatment.
Major	The impact will affect the value and noticeably deteriorate the people's wellbeing. Considerable support and capacity building will be required to manage the adverse impacts, and compensation and resettlement may be required for unavoidable impacts. Medium to long-term health effects; extends beyond the geographic area of a community; serious injury/ illness requiring moderate level of medical treatment.
Moderate	The impact will affect the value and slightly deteriorate the people's wellbeing. Some support and capacity building will be required to manage the adverse impacts. Medium-term health effect; restricted to geographic area of a community; injury/ illness requiring moderate level of medical treatment.
Minor	The impact may affect the value and slightly deteriorate the people's wellbeing. Limited support and capacity building may be required to manage the adverse impacts. Short-term health effect; restricted to a community; injury/ illness requiring minor medical treatment.
Negligible	The impact is unlikely to affect the value and there is no noticeable change to the people's wellbeing. No support or capacity building will be required to manage the adverse impacts.

9.1.5 Mitigation Measures and Residual Impact

For those risks assessed as having a very high, high or medium significance, mitigation measures were identified which served to avoid or reduce the likelihood or consequences of their occurrence. These measures were identified in collaboration with FRL and with reference to:

- Current practices and FRL-supported community programs in the Project area.
- Experience from other mining projects in PNG.
- Input provided by community and other stakeholders engaged throughout the EIS process.
- Government and other group (generally faith-based organisation) community support activities and plans.

The residual significance assessment is based on the assumed effective implementation of identified mitigation measures with justification provided to demonstrate how the mitigation measures act to reduce the significance of the risk. This is presented in Appendix 5 of the SIA.

9.2 Impact Identification

The following aspects of the Project were identified as having the potential to cause a direct positive effect or impact on communities:

- Physical disturbance.
- Physical displacement (including resettlement).
- Access and communications infrastructure.

- Traffic.
- Employment and procurement.
- Project workforce.
- Discharges, emissions and waste disposal.
- Accidental spills and leaks.

The Project also has the potential to cause indirect positive effects and impacts on communities. The following are the primary indirect causes of social change induced by the Project:

- In-migration.
- Distribution of monetary wealth.

Each of these drivers of social change is described below, including definition of the potential positive and negative effects and/or impacts on social values, and a description of the impact pathway. Only potentially adverse impacts have been described where there are no positive effects associated with a driver of societal change.

9.2.1 Physical Disturbance

Land and watercourses and the ecosystems which they support will be physically disturbed as a result of the development of the Project. The total area of direct Project disturbance (i.e., requiring vegetation clearance or land subject to inundation) is estimated to be approximately 16,000 ha (see Chapter 5, Table 5.1) providing the breakdown of the disturbance area for each Project component.

Chapter 8 describes the predicted physical and biological impacts of the physical disturbance arising from the Project. People's wellbeing will be most affected where disturbance occurs on lands which are used by local people for subsistence living or in land areas rich in cultural heritage. Project activities and infrastructure will impede access to land and water-related resources through the placement of facilities such as the ISF, open-pit, process plant, spoil dumps, and other physical barriers such as accommodation villages and fences. People who rely on these resources for their livelihoods (e.g., drinking water, fishing and washing sago) may be affected as the utility or productivity of land or waterbodies are reduced.

While the physical disturbance caused by the Project will have the negative impacts described above, physical disturbance will also indirectly create positive impacts, notably establishment of the public road and transmission line which enable business, employment and social development opportunities. The most common positive impacts of the Project identified by communities include the public road (which they anticipate to provide improved access to markets, economic activity, health and social services) and access to mains electricity.

The positive aspects of the Project are also directly linked to PNG development goals and guidelines, in particular, the PNGDSP which provides policy making direction to achieve the goals of Vision 2050 (see Section 2.1).

While the Project is underpinned by the development of the FRCGP, which is a national priority of the PNG Government, one of the central themes of the PNGDSP is for the PNG economy to advance beyond the mining and petroleum sectors. The Project provides an enabling environment for investment and economic participation through the construction, operation and renovation of physical infrastructure that provides a platform for most other economic activities that are envisaged by the PNGDSP.

The Northern Transmission Line aligns with the Border Corridor economic region, designated in the PNGDSP, for the Western, Southern Highlands and Sandaun provinces. It is envisaged that

the FRHEP and SPGP will supply power to north-west PNG and enable a reliable, long-term supply of energy long after the FRCGP has closed. It will assist in the PNGDSP's target of 70% of households having access to electricity by 2030 and will also support the development of other industries such as agriculture, fisheries, food and timber processing, mining and manufacturing. There is also opportunity to establish a new industry from the export of power to the Indonesian province of Papua. The FRHEP is configured to provide an excess in the order of 150 MW of power to supply a future regional power grid.

The Project includes extension and upgrade of the existing road from Vanimo to Green River, a public road extension to Hotmin, and a 39 km private road to the mine and FRHEP area. A potential connecting road between Hotmin and Telefomin is also envisaged, however is not included in this EIS as it is not required for the development of the FRCGP. The extension and upgrade of the existing roads will contribute to meeting the PNGDSP 2030 target of tripling the PNG road network.

9.2.2 Physical Displacement

The Project will avoid and limit resettlement as much as possible but some resettlement for its development is unavoidable. Up to four villages (Table 9.7) comprising a total of 194 households will be required to relocate. Impacts on these villages will be typical of those associated with resettlement exercises and will require attention to the following elements:

- Direct support for the re-establishment of housing.
- Direct support during the physical transition phase.
- Compensation for gardens and other physical assets lost or impacted by the Project.
- Infrastructure and service re-establishment.
- Support for livelihood restoration.
- Re-establishment or compensation for business losses.

Table 9.7 Villages subject to potential resettlement

Village	Households (2017)	Families / persons (2017)	Reason for resettlement
Frieda River Hydroelectric Project			
Wabia	66	83 / 393	Inundation following establishment and operation of the FRHEP means that these villages cannot remain in their present locations under the current FRHEP design.
Ok Isai	57	93 / 465	
Paupe	38	51 / 262	Multiple construction phase impacts due to proximity to the ISF (Paupe is approximately 5 km downstream of the hydroelectric power facility) and FRHEP access road, potentially reducing amenity to an unacceptable level. Adverse impacts are likely to include: air and noise nuisance during construction and operation of the FRHEP access road; significantly reduced flows in the Frieda River during filling of the ISF; loss of Frieda River for aquatic resource use during seven year implementation period due to fugitive sediment; and proximity to large construction camp.

Table 9.7 Villages subject to potential resettlement (cont'd)

Village	Households (2017)	Families / persons (2017)	Reason for resettlement
Mine area			
Wameimin 2	33	36 / 196	<p>Proximity to Nena deposit (approximately 3 km east-northeast) presents risks for the potential future development of the Nena deposit as a 'brownfield' expansion to the FRCGP.</p> <p>The proximity of Wameimin 2 to the access road route also increases the risk of attraction for in-migration to the village, before and during FRCGP development, with consequent population growth and therefore increased resettlement costs should 'brownfield' resettlement be required in future.</p> <p>In the event the Nena deposit was developed, Wameimin 2 would likely be affected by air, noise and vibration impacts during construction and operations, significantly reducing amenity in the village.</p>

Arguably the single biggest social impact of the Project will arise from the resettlement of the four villages, which also includes the following positive effects when compared to present conditions:

- Higher standard of housing and infrastructure.
- Improved facilities including water supply and health care clinics.
- Improved health outcomes resulting from the improved standard of housing, water supply and access to health care.
- Improved access through construction of all-weather roads to the resettlement village locations, enhancing opportunities for business.
- Livelihood restoration programming will include a range of rural extension programs aimed at maximising the value of economic opportunities for affected communities including:
 - Enhanced techniques for improving agricultural productivity.
 - Identifying cash cropping opportunities for local and regional markets.
 - Financial literacy and long-term investment planning to support compensation and royalty management.
 - Small, medium and larger scale business development mentoring.
- The scope of business opportunities will be enhanced as relocated communities will be prioritised for mine employment and for opportunities to engage with the Project's supply chain.
- The Project will design literacy and vocational training programs that increase the capability of the local communities to take up opportunities with the Project.

9.2.3 Access and Communications Infrastructure

The Project will include the construction of a public road between Hotmin and Vanimo, along with an access road to the mine and FRHEP. The distance by road between the Vanimo Ocean Port and the mine area is approximately 325 km. A 65 km section of access road will be constructed from end of the public road in Hotmin, through the mine and FRHEP area, to the Frieda River Port, and a 20 km temporary access road will be constructed from the mine access road to the May River Port. Once the main access route is constructed, materials and equipment will be loaded onto trucks at Vanimo and travel directly along the public and mine access roads to site.

The road between Hotmin and Vanimo (286 km) will be a gazetted public road. A private road will extend from Hotmin to the mine (39 km) within a mining easement. The road section within the mining easement will be a controlled access road (rather than a public road), with public travel only available under strict conditions.

The existing port of Vanimo will be upgraded to provide import and export facilities for construction and operations of the Project as described in Chapter 5.

Site-wide communications, information technology, fire services and security links will be via a fibre optic network linking all facilities. A fibre optic cable will be run with overhead lines and underground 33 kV power reticulation to each facility. Similarly, a fibre optic cable will run along the concentrate pipeline enabling communications between the process plant, booster pump stations and the concentrate filter plant at the Vanimo Ocean Port. A satellite link will be installed in the mine area for communications during construction and will be retained during operations as a back-up to the fibre optic network. There is potential for access to communications infrastructure by local communities.

Road and communications infrastructure will improve access to, and knowledge of, markets, education and health services along with increased opportunity for community engagement and participation in society. However, improved accessibility also provides potential for higher exposure to communicable diseases, in-migration and socially disruptive and illegal activities.

There are a number of positive effects that will result from increased access and communications. The development of the Project will significantly improve the potential for long-term development, both within the Project area and in PNG more broadly, because it will build roads to previously isolated locations that had limited prospects for economic development. The Project will improve access to external markets and reduce the cost of transporting local products to market. The Project will also enhance the economic potential of Green River (consistent with the Sandaun Provincial Government plan for Green River as a 'Level 2' growth centre for the province) through the upgrade of the airstrip and road link to Vanimo. Similarly, Vanimo's presently limited economic potential will be improved significantly, consistent with the Sandaun Provincial Government plan for Vanimo as a 'Level 1' growth centre for the province.

Other specific positive effects of the Project associated with access and communications include:

- Improved access to health and infrastructure services arising from the road development. Establishment of communications infrastructure may improve access to medical information and assistance including emergency response.
- Improved access to educational facilities which will also reduce travel time to schools and enhance access in general. Increased ease of access to secondary and vocational schools may lead to the achievement of higher levels of education which may increase outward migration.

- Greater access to business and to markets for sale of produce and cash crops which will provide an opportunity for the sale of surplus goods that could lead to commercial-scale growing and sale of produce and cash crops, providing an ongoing source of income to rural families, particularly women. Such access will also likely promote the establishment of small-scale family enterprises selling garden produce and other products, such as small goods and consumer items, to the workers and other people who use the access road.
- Increased availability of food and other resources supplied from outside areas due to road access.
- Improved communications have the potential to lead to improved financial and marketing services which can lead to wealth creation and savings.
- Improved levels of education and availability of cash may result in a strengthening of cultural and social values, as has been observed to some extent at Lihir and Misima.

9.2.4 Traffic

The Project will generate vehicular, air and water-based traffic throughout construction and operations. A 325 km infrastructure corridor will be developed between the mine area and Vanimo Ocean Port. This will include:

- 286 km public road from Vanimo to Hotmin.
- 39 km mine access road from Hotmin to the mine.
- A buried 325 km pipeline to transport concentrate slurry from the mine site to Vanimo Ocean Port.
- The Northern Transmission Line from the FRHEP to Vanimo Ocean Port which will provide power to the FRCGP facilities, with excess power made available to communities along the infrastructure corridor, other regional users and for export.

During Road Construction

Project equipment and consumables will be transported via ocean freighter to existing ports at Wewak, Lae and Madang and barged upstream along the Sepik River to the Frieda or May River ports until upgrades to both the Vanimo Ocean Port and the Vanimo to Green River Road have been completed (which is expected to take about one year).

During Mine Construction

Once built and operational (Year-4 of seven-year implementation period), the public road from Vanimo to Hotmin will be used to support construction of the FRCGP and FRHEP. An estimated five truck movements (prime movers with 12 m trailers) and eight buses per day are expected to travel between the Vanimo Ocean Port and the mine and FRHEP area during the mine construction period. In addition, the Project will generate light vehicle movements along the road for the transport of materials and people throughout the construction period.

Mine and FRHEP construction will generate an estimated one barge movement (round trip) per day from the Lae, Madang and Upper Sepik River ports along the Sepik, May and Frieda rivers to the river ports until the public road and mine access road are completed. From the Frieda River Port, freight will be transported to the mine and hydroelectric power facility via the FRHEP access road using heavy vehicles with an estimated five vehicle movements per day. A temporary access road will be constructed from the May River Port to a point on the mine access road

approximately six kilometres east of Hotmin to mobilise equipment for construction of the resettlement villages.

Air travel will initially use the existing Frieda River airstrip which will be upgraded to support personnel movements until the Green River Airport upgrade is completed, which will then be the main airport used for transport of personnel during construction. The Frieda River airstrip will be used for some ongoing personnel transport and emergency purposes during operations. For the transport of construction personnel, it is estimated that three flights will fly in and out of the Frieda River airstrip per week at peak usage. Buses and light vehicles will transport personnel between airstrips and accommodation villages. During construction, it is estimated that there will be a requirement for approximately eight bus movements (round trips) per day between the Green River Airport and the mine site.

During Operation

Equipment and supplies will be transported via road during operations. Buses will be used to transport personnel between points of hire along the public road and from the Green River Airport to the mine. Riverine transport using barges is likely to be used for transport of Zone 2 workers (e.g., workers from Inlok).

From the Green River Airport it is estimated that there will be an average of seven flights using Twin Otter aircraft each week to regional airstrips and fourteen 50 seater flights to commercial airport hubs each week. The Frieda River airstrip will be used during operations to transport local workers and short-roster management personnel.

During operations it is estimated that the number of bus movements per day between the Green River Airport and the mine site will reduce to three.

Project shipping movements at the Vanimo Ocean Port are estimated at seven per month, comprising four shipments of concentrate at peak production (at 20,000 tonnes each), one shipment of fuel and two shipments of general cargo.

Increased road, water and air traffic can have implications for human safety and wellbeing. Traffic generates noise, dust, light and air emissions and heightens the risk of accidents. The risk of accidents is more likely due to people's unfamiliarity with road traffic given the isolation of the Project area, particularly in the mine and FRHEP areas. Most traffic and barge movements will be generated during the construction phase of the Project and will reduce during operation with corresponding decreases in potential health, nuisance and safety issues. Ocean and river port construction and barge and watercraft movements also have the potential to impact on fishing activities, e.g., deployment of fishing nets, and barge vessel wash has the potential to increase erosion of riverbanks adjacent to villages. Crocodile farming is not expected to be impacted by barge and watercraft movements as breeding activity and local community harvesting of crocodile eggs, juveniles and adults occurs in off-river waterbodies rather than main river channels (i.e., the Frieda and Sepik rivers; see Appendix 8c) which will not be impacted by the Project, except for potential short-term turbidity impacts associated with road and pipeline construction.

Opportunities related to the Project are discussed further in Section 9.3.

9.2.5 Employment and Commercial Participation

Employment

Development of the Project will generate significant employment opportunities in a remote part of PNG that has little formal employment. The estimated workforce numbers onsite during the seven-year implementation period will peak at approximately 5,200 personnel, including approximately 2,300 contractors for the FRHEP. In the operations phase, it is estimated that the Project will require an average of approximately 2,500 personnel. Most of these workers will be PNG nationals with some expatriate employees, contractors and support staff.

FRL's six designated recruitment zones and its approach to workforce recruitment are described in Section 5.11.1

Workforce recruitment will be prioritised for:

- People from landowning communities within the SML, ML and LMPs (Zone 1).
- Communities within the Telefomin LLG and the western part of the Tunap Hunstein LLG, along the infrastructure corridor, and along the Sepik River downstream of the Frieda River. (Zone 2).
- Sandaun and East Sepik provinces (Zone 3).
- Any other provinces within PNG (Zone 4).
- Australia (Zone 5)
- Asia (Zone 6)

Training will be required for the local workforce, although some local residents may have previously worked at other resource projects such as Ok Tedi and Porgera, and already have experience and skills acquired through relevant training. PanAust has demonstrated a strong commitment to local training and skill development at its operations in Laos and will implement similar capability development programs to ensure commitments to local employment and workforce progression are met.

Commercial Participation

Economic activity associated with construction and operation (through local contracts for the procurement of materials, goods and services) will also lead indirectly to the creation of employment opportunities in the local economy. This will increase the capacity of people employed by the Project to purchase goods, health and education services and luxury items. Flow-on effects from the injection of wealth into this economy will allow new businesses to establish and existing businesses to expand operations. There will also be a significant growth of new businesses as a result of Project related contracts.

The total initial capital investment for the Sepik Development Project will be up to US\$6.9 billion (PGK21.7 billion² in October 2018) in real terms (ACIL Allen, 2018). Recurrent operating expenditure for the FRCGP and the FRHEP, including a significant level of local spending on support services, is estimated to average US\$685 million (PGK2.2 billion) per year (ACIL Allen, 2018).

² US dollars are converted to Kina at an assumed exchange rate of US\$1.00 = 3.15 Kina.

The purchase of materials and services from within PNG will result in a higher level of activity in the local and national economy. This growth will lead to the creation of additional employment opportunities and stimulate further growth and development of the economy. It is estimated that, over the first 40 years of the Project, for the Sandaun and East Sepik provinces, the Project will result in an increase of PGK83.6 billion in regional real GDP and an increase in regional real income of PGK39.2 billion (ACIL Allen, 2018).

Over the first 40 years of the Project, real national GDP is estimated to increase by a cumulative value of PGK96.5 billion (US\$30.6 billion), and tax, royalty and production levy revenue to PNG governments and landowners is expected to total PGK29.0 billion in real terms (ACIL Allen, 2018).

Employment, business development and procurement can also result in negative impacts including a shortage of labour to assist with rural livelihoods, dietary change and associated health effects, and accelerated change in traditional leadership and social practices.

The benefits and opportunities from increased employment and participation include:

- Direct increase in wage income through formal mine employment, with additional employment opportunities stemming from increased cash circulation in the local economy.
- Business development linked to the Project, both for local landowners and regional communities.
- Improved housing and expenditure on personal health and consumer goods that improve standards of living.
- Improved population skill levels through workplace training and education, particularly for women.

9.2.6 Project Workforce

The Project will require the presence of a large construction and operations workforce in the Project area, which is currently sparsely populated. The management of workforce accommodation will be a key factor influencing the manner in which the Project workforce interacts with the host community. There will be a range of construction camps and accommodation facilities for the Project (see sections 5.5.8, 5.6.13 and 5.7.3) with the largest of these being at the mine and ISF sites.

A portion of the construction and operations workforce will likely interact with communities close to Project activities. Such interactions can lead to a range of issues including health (such as facilitating the spread of diseases), disorderly behaviour and access to drugs and alcohol, though there will be strict enforcement of drug and alcohol use with Project employees while on Project sites. More people in an area can also lead to damage to land and water resources e.g., land clearance for new settlements and wastewater discharges, as well as damage to cultural heritage sites due to a limited appreciation of locally significant sites. In addition, an influx of foreign workers, who may come from a range of different cultural backgrounds, can be a source of animosity within the workforce and between the workforce and local communities. In particular, there may be a perception that 'outsiders' are taking jobs from local people. Such animosity can result in tension, conflict and, ultimately, violence if not managed appropriately.

A positive impact of the workforce presence will be increased income for local people, particularly women who sell goods, such as locally-grown food, and services, such as accommodation servicing, to sustain the workforce. This will be particularly relevant to villages along the

infrastructure corridor between Hotmin and Green River (Social Catchment 1B) proximal to road construction, and villages within a daily commuting distance to Project accommodation facilities.

9.2.7 Discharges, Emissions and Waste Disposal

As described in Chapter 8, Project activities will result in the discharge of water, the generation of dust, and the emission of air pollutants, noise and light to the surrounding environment. People who live near, or downstream of, Project construction and operations may be affected by changes to quality and quantity of land and water resources on which they depend. With Paupe being resettled away from the Frieda River, likely to a location on Kaugumi Creek, residents will have access to a piped water supply and will not be dependent on water from the Frieda River. Perceptions about water quality due to perceived and/or actual impacts from ISF discharges will also require active management.

In addition, the Project has the potential to generate a variety of wastes through the construction and operation of infrastructure, and through increases in population within the Project area and surrounds as a result of in-migration. Few, if any, dedicated sanitary or other waste disposal facilities exist in local communities. Areas around the accommodation camps and communities located near Project infrastructure may experience increased littering and contamination of water supplies as a result of inappropriate waste disposal, with corresponding effects to people's wellbeing and health.

9.2.8 Accidental Spills and Leaks

Accidents or equipment failures may cause spills and leaks of hazardous materials. A range of hazardous materials will be transported along the Sepik, Frieda and May rivers by barge and stored at the river ports during the Project construction period. Hazardous materials including fuels, oil, solvents and other chemicals will also be transported by vehicle along the road routes. Copper concentrate will be filtered and stored at the Vanimo Ocean Port. These materials are potentially hazardous to ecological and social receptors if an accidental spill or leak were to occur. FRL will implement operational standards to prevent such an event occurring. In the unlikely event of a spill or leak occurring, it will most likely be relatively small and will be contained within the immediate area by physical barriers such as bunds. Major spills could occur although this is a very low probability.

Structural failure of the ISF, and any associated discharge of contaminated water or tailings and waste rock, would have serious long-term downstream effects on the Frieda and Sepik rivers, and the communities which rely on riverine resources, and is of significant concern to the residents of those communities. There have been instances within PNG and elsewhere of tailings storage facilities failing, and there is an associated level of public awareness about the consequential environmental effects. There is also heightened sensitivity in PNG to the downstream impacts of riverine tailings and waste rock discharge due to the observed effects at Panguna, Porgera and Ok Tedi mines in particular. While a 'dam break' analysis, simulating a very low probability failure event, was undertaken to inform the design of the ISF and to ensure that appropriate factors of safety have been incorporated into the design, the analysis illustrates the catastrophic consequence in the unlikely event of a dam wall failure (see Sections 5.6.11 and 11.3.1). Hence, community anxiety of such an event occurring is an important social impact associated with Project development, even if such anxiety is expected to decrease over time.

9.2.9 In-migration

In-migration is a term used to describe the movement of people into an area in anticipation of economic opportunities associated with the development of a project. Such opportunities include employment, trade and other commercial opportunities arising from wealth generation in an area. In-migration is a phenomenon in PNG which occurs due to personal motivation to access economic opportunity and has been documented at other mining projects in the country. The potential impacts that result from in-migration are indirect rather than directly attributable to the Project.

To inform the potential for the Project to induce in-migration, FRL undertook a study (Jackson, 2018) that concluded that significant in-migration will occur if the FRCGP was to advance to development. The likely primary sources of in-migrants are Telefol people, the Sepik (particularly the Middle Sepik/Wosera-Gawi but also potentially from the East Sepik) and Min people, who had moved previously to Tabubil due to the Ok Tedi mine, returning to the Telefomin area. These conclusions are supported by the genealogical and other social linkages held by the Miyan, Telefol and Paiyamo villages in Social Catchment 1A. The potential for in-migration from the East Sepik area is slightly attenuated due to the main Project area access being via a road to Vanimo, however the Sepik corridor area is still considered to be a potentially significant source for in-migration.

Development of the FRHEP will result in resettlement of Ok Isai, Wabia, Paupe and Wameimin 2 villages. Ok Isai and Wabia will be resettled as these villages are located in the footprint of the ISF. Wameimin 2 will be resettled due to the likely construction and operations phase impacts from the potential future development of the Nena deposit which is located approximately 3 km from the village. Paupe will need to be resettled due to multiple prolonged construction phase impacts arising from proximity to the hydroelectric power facility of which is approximately 5 km upstream of the village and the FRHEP access road, potentially reducing amenity to an unacceptable level. Negotiations are currently underway over the selection of new sites to relocate the four villages.

The infrastructure corridor between the mine area and Vanimo creates a dominant pathway for potential migrants to the mine and FRHEP area, using the public road, with a significant secondary pathway being via the Sepik River (Jackson, 2018). The Sepik-Frieda waterway route remains important in terms of migration as migrants do not need road links to move. The mine and FRHEP will still have an attraction for potential migrants from along the length of the Sepik River, as the river is navigable to the location of the planned Sepik River bridge crossing.

The overall implications of the infrastructure corridor between the mine and FRHEP area and Vanimo are extremely positive for regional development, linking large parts of Sandaun Province to the coast for the first time (Jackson, 2018). Access controls to be installed between Hotmin and the mine area, and the hydroelectric power facility and Frieda River Port, will act as a major inhibitor to unauthorised movement into these Project areas. The junction of the public and private mine access road at Hotmin has the potential to become a focal point for a wide range of economic activity and population movement, due to the tendency for migrants to attempt to locate as close as possible to the source of potential economic opportunity (Jackson, 2018).

The Frieda River will remain accessible to boat traffic and access to the FRHEP area via the river will still be relatively easy. As such, Sepik River people with access to canoes will traverse the Frieda River to the Frieda River airstrip as they have done for many years.

The planned resettlement of Paupe village will release land area along the river banks which will be attractive for migrant settlement. When Paupe is resettled, it will be important that the land it currently occupies is secured by the Project to limit the attraction for in-migration to this point. This is because Paupe and the Frieda River airstrip are still hotspots through which migrants from the middle and lower Sepik region might be expected to pass or occupy.

Ok Isai and Wabia are to be resettled, with the flooding of their lower lying land by the FRHEP removing the attraction of the associated alluvial gold which has drawn migrants in the past. Wameimin 2 will also be resettled due to its proximity to the Nena deposit and associated construction and operation impacts should this deposit be developed. However, the relocation of these villages will diminish their attraction for other Telefol and Min people desirous of living close to the Project seeking associated benefits and opportunities.

Land along the length of the Vanimo to Hotmin public road is, to some degree, vulnerable to in-migration, particularly from the point at which the private road extends from Hotmin to the mine area. In cultural terms, however, this is not ideal because it is in Miyanten territory. The Miyanten may not be especially concerned about migrants arriving from the south, as they have reached an amicable agreement with the Telefol people over general Project land ownership and benefit-sharing matters. However, it would strain that emerging relationship which is crucial to the management of the Project overall if large numbers of Telefol people or other Min moved into and settled at this site. Also, while many Telefol people and other Min might opt to move towards the resettled villages of Ok Isai and Wabia, or to walk from Telefomin town into the Elip Valley to gain access to the mine area, as incomes increase and public motor vehicle services emerge, more and more people are likely to converge on this Hotmin junction point.

The development of the Project will significantly improve the potential for long-term development at several points within the overall Project area because it will build roads to previously isolated places which had little prospect of viable economic development. The Project will also enhance the economic potential of Green River through the upgrade of the airstrip, in addition to linking it by road to Vanimo. Green River has the existing advantage of ready access by river for the downstream population of the Sepik River. Similarly, Vanimo's presently limited economic potential will be significantly improved. In these locations, some additional migration will occur as a consequence and, in all three places, such inward migration will be viewed by most existing residents and by their local governments as a positive development and a sign of progress.

In addition, in-migration will increase the number of people to which local people can sell goods in the Project area, which will increase incomes. People migrating to the area may also be associated with business enterprises that service Project construction and operations, and which will likely employ local people from the Project area, thereby contributing to increased local incomes.

The level of in-migration likely to be generated by the Project is difficult to accurately predict, however it is likely that there will be an initial surge of people into the Project area. The rate of in-migration may diminish after construction is completed and after arrangements relating to the distribution of Project benefits are finalised, however that is uncertain and it may remain at high levels well into Project operations.

The relatively rapid movement of people into an area will likely cause changes in host communities. While in-migration may ultimately benefit local trade, employment, infrastructure

and services, there can also be negative economic, health and social consequences for host communities, particularly in the short term. These negative consequences include:

- Pressure on land and resources and a greater demand for terrestrial and aquatic resources leading to a decline in garden productivity and reduced availability of subsistence resources.
- Price inflation due to pressure on resources and increased income, resulting in food shortages and reduced affordability for people to purchase food.
- Restricted business and employment opportunities for local communities due to in-migration of more experienced business operators.
- Damage to cultural heritage through land clearance for settlements and a limited appreciation of the significance of cultural heritage sites.
- Demand for land and resources close to settlements leading to an inability to maintain customary rights and practices associated with such land and resources.
- Disruption to social relations and community wellbeing.
- Impaired community safety and security due to increased infringement of law and order.
- Higher incidence of infectious diseases.
- Reduced availability of health and education services due to increased demand.

9.2.10 Distribution of Monetary Wealth

The Project will generate substantial landowner incomes, some of which may be saved, however a significant portion of which is expected to be spent and contribute to the incomes of a variety of entities throughout PNG. The resultant impacts are indirect rather than directly attributable to the Project, as the management of such wealth is determined by parties external to FRL, and as such are outside the control of FRL.

The Project will financially benefit the regional economy through the procurement of goods and services, payment of wages and the distribution of Project benefits. This wealth will diffuse into other sectors of the economy, thereby increasing market activity at the regional scale. The Project will also result in local entities being able to generate additional income through service delivery and the associated creation of direct and indirect employment opportunities.

The term 'Project financial benefits' refers to income which will accrue to the PNG Government and applicable landowners because of this Project. The major items of income will be:

- Taxation:
 - Company tax payable by the Project owners.
 - Personal income tax from employees.
- Production and development levies.
- Royalties.
- Compensation payments.
- Equity participation (leading to dividends).

Financial benefits will include increased revenue to the PNG Government, the provincial governments, local-level governments and landowners, extending to the completion of the Project operations phase.

The quantum of Project financial benefits will be influenced by the extent to which the Government of PNG takes up its option to acquire a participating interest in the Project. Economic modelling undertaken by ACIL Allen (2018) indicates that if the full participating interest (30%) was acquired, potential returns to the PNG Government is estimated to total PGK17.2 billion (post-tax, ungeared) or PGK12.1 billion on a post-tax, geared basis after financing.

While these benefits are significant, the ongoing mining and electricity generation operations and their associated infrastructure provides significant potential to influence economic performance throughout the economy as a result of flow-on effects to other industry sectors. Economic spending by Project participants, employees, government and landowner beneficiaries will lead to 'multiplier effects' as the economic activities associated with the Project flow through the broader economy. Investment in productive physical assets (e.g., infrastructure for power generation, roads and airports) and in social assets (e.g., improved education and health services) can also benefit the economy by enhancing the productivity of economic factors (ACIL Allen, 2018).

The PNG Government-led development forum process will determine how the equity, royalties and development levy benefits are allocated among landowners and various levels of government. Project area landowners will receive direct benefits depending on the activities carried out on their land. The quantum of benefits flowing to beneficiaries will vary, with the owners of lands over which the SML is granted likely to receive the highest level of financial benefit and those along the infrastructure corridor receiving substantially lesser amounts.

There is the potential for negative impacts associated with Project benefits. Contested landownership can place strains on social relations within and between communities. The distribution of cash to beneficiaries, most of whom have not previously had access to substantial cash incomes, can promote changes to traditional lifestyles and systems of governance. Cash incomes can also be allocated to gambling activities and the consumption of alcohol and drugs, with the potential to lead to increased public and domestic violence.

However, increased incomes and Project-related benefits will have a number of positive effects including:

- Supporting the production and purchase of subsistence resources and services, improving subsistence livelihoods.
- The allocation of surplus funds to savings and wealth creation through both Project-related and non-mine dependent opportunities.
- The stimulation of aspects of traditional wealth exchange and display culture, such as feasting and public ceremonies.
- Investment in infrastructure provision and maintenance, contributing to the provision of educational and health infrastructure and services.

9.3 Opportunity Capture

Sandaun Province and the western districts of East Sepik Province are amongst the least developed in PNG. Broad-scale development initiatives, such as the West Sepik Provincial Development Project (World Bank, 1984), have been implemented in the past, though have met with limited success (World Bank, 1994) due to the complexity of implementation in remote areas lacking basic social and physical infrastructure. Where infrastructure was provided, it had little impact on agricultural production due to rapid deterioration and a lack of commitment to maintenance.

In addition to the FRCGP, new and upgraded road infrastructure and the provision of power to communities along the road corridor has the potential to generate a broad range of positive social effects and opportunities across communities in the western half of Sandaun Province that currently have minimal access to the cash economy, work and business opportunities, health and education services, and community and regional infrastructure. As well, the distribution of high voltage power to Vanimo and the Indonesian border area at Wutung, and potentially in the longer term the Aitape and Wewak areas if additional transmission lines are developed to this region, should act to stimulate private sector development in these areas. The low voltage SWER power line along the infrastructure corridor as part of the SPGP provides the potential for a third-party provider to connect communities along the infrastructure corridor to a long-term, reliable and sustainable power supply. The supply of electricity to these communities has the potential to significantly improve education, health, trade, village amenity and community infrastructure, as well as creating opportunities for a higher level of women's participation in economic activities. While the earlier provision of infrastructure to communities between Vanimo and Green River was not maintained (either by government or private users such as logging companies), the Project will maintain the public and private road links to the mine area for at least the life of the mine (33-plus years), supporting the longer-term development of agricultural industry and government delivery of social services such as health and education along the road.

The employment preference policies of the Project should result in a significant number of highly paid positions accruing to both Sandaun and East Sepik residents during the life of the mine. A conservative estimate of wage income across both provinces is in the order of PGK112 million per year. While this will drive business development to service private consumption, it should also provide equity for investment in new enterprises and contribute to taxation revenues in both provinces. This, together with royalty payments, should enhance the capacity of the provincial governments to fund service delivery and the maintenance of public infrastructure over the long life of the Project.

Indicative opportunities include:

- Opportunities for employment (and receipt of associated income) and skills acquisition, both for males and females.
- Opportunities for the development of local economies including trading businesses and potentially cash-cropping due to improved access to input and product markets.
- Landowner receipt of statutory payments including royalties and compensation that may be applied to consumption or investment.
- Access to improved village-level infrastructure and service delivery in health and education.
- For resettled communities, access to improved village-level infrastructure including new houses and water and sanitation facilities.
- Access to regional infrastructure such as improved road transport links to Sandaun service centres, and the provision of telecommunications facilities.
- Opportunities to establish community programs to improve family and gender relations and increase support for other vulnerable groups such as youth and the disabled.

The Project will generate several benefit streams that are likely to result in greater provincial and national wealth, particularly from royalties and taxes. The notable aspects of these benefit streams include (ACIL Allen, 2018):

- Direct FRCGP initial capital investment in PNG of more than US\$2.8 billion (PGK8.8 billion) in real terms.
- FRCGP recurrent operating expenditure averaging US\$655 million (PGK2.1 billion) per year including significant local spending on support services.
- Gold, copper and silver production valued at an average US\$1.5 billion (PGK4.8 billion) per year.
- Direct FRHEP capital investment in PNG of more than US\$3.2 billion (PGK10.1 billion) in real terms.
- FRHEP recurrent operating expenditure averaging US\$30 million (PGK94.5 million) per year including significant local spending on support services.
- Project construction workforce peaking at approximately 4,200 full-time equivalent workers, and an operating workforce of approximately 2,430, with the majority (90%) being PNG nationals.
- Tax, royalty and production levy revenue to PNG governments and landowners from the operation of the FRCGP in the order of PGK24.4 billion in real terms over the life of the Project (an average of K610 million per year for 40 years from 2021).
- Tax (company tax and PAYE tax) payments to PNG governments and landowners from the operation of the FRHEP in the order of PGK4.9 billion in real terms over the life of the Project (an average of K121 million per year for 40 years from 2021).

Government and the Project proponent will need to work together with communities to develop practical, affordable and achievable plans for development to ensure that these opportunities present realistic, enduring and intergenerational benefits, particularly for mine area communities. At a local scale, the receipt of Project income may be used to improve health and education levels within communities, and to develop business enterprises such as supply companies and maintenance providers.

FRL's focus will be on providing foundational and discretionary community development support across priority villages to catalyse development across the two core themes of 'skilful' and 'healthy'. It is proposed that priority projects under these two themes will be developed and funded in consultation and partnership with host communities and government, with broad parameters agreed through the Development Forum, and focused on Social Catchment 1A communities who are most affected by the Project (Section 9.5.1 provides further discussion). FRL proposes to discuss with government the potential for access to the Tax Credit Scheme (TCS) for priority infrastructure projects, as well as the potential for government infrastructure grants for the Telefomin area, infrastructure corridor between the mine area and Vanimo and the coastal area of Vanimo located between the East Sepik and Sandaun provinces.

FRL has developed a draft Business Development and Supply and Procurement Plan, required as part of its submission to apply for a SML. Key initiatives under this plan are the establishment of the Business Development Office that will include business development staff dedicated to assisting independent businesses owned by clans, sub-clans, family groups and individuals (from communities within the SML and other lease areas) to undertake minor contracts for the provision

of services. Many of these contracts will be suitable for youth groups, women's groups, church groups and others.

FRL will also assist in the formation and operation of a company to represent the landowners of the SML in larger contracts with the Project where appropriate. Subject to capacity, FRL will source goods and services from suppliers based on the following order of preference:

- Owned by recognised landowners from the Frieda River area.
- Based in Sandaun Province.
- Based in East Sepik Province.
- Based elsewhere in PNG.
- Based overseas.

All tendering for the provision of goods and services to the Project will be on a strictly commercial and competitive basis with a focus on price, quality and schedule.

A significant opportunity associated with the Project, for both local and provincial residents, is participation in employment. FRL has developed a training and development strategy to support workforce development and ensure that unskilled local and provincial residents are able to participate to the maximum extent possible. This strategy will be implemented by a dedicated Training Section within the Human Resources Department supported by embedded skills training specialists in operating departments. Training will occur at a primary training centre at the mine site and within operational workplaces. A secondary training centre will operate in Vanimo for the provision of apprentice/trade training and specialist development training which is best delivered away from the workplace. In addition to standard operator and trades training, FRL will implement a 'workforce culture program' prior to start-up and in the early stages of operations. This program will be important in establishing a consistent employee culture within the Project workforce as some employees will be recruited from communities across PNG with different cultures, languages and values. A proposed community development fund will incorporate an initiative designed to build the literacy and numeracy skills of the mine area social catchment residents to access work opportunities. The proposed Project approach therefore reflects a partnership between the Community Affairs and Human Resources departments to enable local communities to optimise opportunities presented by access to work.

Project employment and training will provide long-lasting benefits for communities. People employed and trained by the Project will learn valuable skills that they would likely otherwise not have access to, particularly in social catchments 1A, 1B, 1C and 1D. This will provide people with the ability and confidence to seek employment elsewhere in the mining and resources industry in PNG and internationally, should they choose to do so. A good precedent exists at the former Misima mine where, 13 years after mine closure, charter flights allow people from Misima to work at the Porgera, Lihir and Ok Tedi mines. The seven year construction and 33 year operating life of the FRCGP will provide the potential to train many people over the life of the mine.

Increased access to infrastructure and transport links will present a significant opportunity for communities within the Project area. The proposed public road will provide communities with increased access to markets, enabling opportunities for the sale of surplus goods that could lead to commercial-scale growing and sale of produce and cash crops, thereby providing an ongoing source of income to rural families, particularly women. Such access will likely promote the establishment of small-scale family enterprises selling garden produce and other products such as food and consumer goods to the workers and other people who use the public road.

Access to health and educational facilities will be improved because of the development of road and communications infrastructure. This could include medical clinics, hospitals, specialist services and schools, the quality of which could be significantly improved by a long-term, reliable and sustainable source of power and a long-term, sustainable income stream available to provincial governments. The development of communications infrastructure will likely improve access to medical and educational information and assistance, as well as facilitate more efficient commerce. Development of the Vanimo Ocean Port and the SPGP will likely stimulate trade between PNG and Indonesia and generate employment opportunities.

9.4 Mitigation Measures

Socio-economic impacts associated with all Project construction and operation activities will be managed through implementation of the Project EMMPs (Section 12.3 and Attachment 2). Complementing the EMMPs will be six Social Management Plans which together will act to both manage socio-economic impacts and support the capture of socio-economic opportunity made available by the development of the Project. These plans are the:

- Cultural Heritage Management Plan.
- Community Development Plan.
- Business Development, Supply and Procurement Plan.
- Human Resources and Localisation Plan.
- In-migration Plan.
- Resettlement Plan.

The social management framework includes the Stakeholder Engagement and Management Plan and the Grievance Management Procedure which are essential for maintaining a constructive dialogue with potentially affected individuals and communities. The inclusion of the FRCGP Conceptual Mine Closure Plan within the framework also provides a reference for the management plans to promote capacity development aimed at mitigating the impacts of eventual mine closure.

Table 9.8 describes the management and mitigation measures that FRL has committed to address impacts to social values from Project activities. Stakeholder access to and use of the Grievance Management Procedure (SEM057) is a mitigation measure applying to all identified impacts.

Table 9.8 Management and mitigation measures

Mitigation number	Mitigation title	Mitigation measure
SV1 – The Capacity to support subsistence livelihoods		
SEM001	Vegetation clearance mitigation measures	Implement vegetation clearance management and monitoring measures in the Project Biodiversity Management Sub-plans.
SEM002	Terrestrial fauna mitigation measures	Implement terrestrial fauna management and monitoring measures in the Project Biodiversity Management Sub-plans including the avoidance of areas with high biodiversity values and the management of disturbance to fauna, where possible.

Table 9.8 Management and mitigation measures (cont'd)

Mitigation number	Mitigation title	Mitigation measure
SV1 – The Capacity to support subsistence livelihoods (cont'd)		
SEM003	Water management and monitoring	Implement water management and monitoring measures outlined in the Project EMMPs including diverting clean water away from disturbed areas, not washing machinery near watercourses, meeting discharge requirements described in environment permit conditions and documenting and investigating complaints about water quality.
SEM004	Resettlement Action Plans	Develop and implement Resettlement Action Plans in collaboration with residents of villages to be resettled. Ensure that livelihood restoration measures are coordinated with other social management measures (e.g., in-migration management, recruitment strategy, lease boundary monitoring, provision of regional infrastructure and services) and are monitored for effectiveness.
SEM005	Weed management plans	Implement weed, plant pathogen and pest management controls within the Project EMMPs.
SEM006	Pre-construction surveys	During road pre-construction surveys, identify construction water source locations that avoid impacting local community water supplies. If impact is unavoidable, implement measures to provide an alternate water supply.
SEM007	Information on construction impacts	Provide briefings to local communities on when and where construction will occur, what potential construction impacts may occur, and the means of communicating with contractors and the Project around issues, including the use of the Project Grievance Management Procedure.
SEM008	Fish and crocodile stocks	Monitor fish and crocodile stocks and local harvest at select locations prior to construction, at regular intervals during construction, and six months post construction. Develop an operational response in the event that surveys indicate impairment of local harvest due to the Project.
SEM009	Engagement process	Ensure the Project has an active engagement process in villages downstream of the mine area to address concerns about the environmental integrity of the waterways on an ongoing basis.
SEM010	Erosion and sediment control	Implement and maintain erosion and sediment controls as per the Project EMMPs.
SV2 – Opportunities for participation in the cash economy		
SEM011	Compensation – cash economy	Ensure that fair and equitable compensation is provided to parties affected by Project related impacts on subsistence resource use or existing income generating resources or activities.
SEM012	Wealth capture and creation	Design, encourage and implement mechanisms (such as bank accounts) to capture a reasonable portion of direct monetary payments (royalties, compensation, resettlement) and encourage these funds to be re-invested for further wealth creation including inter-generational.
SEM013	Wealth distribution	In partnership with stakeholders, design, encourage and implement wealth distribution systems across the range of benefit streams including royalties, compensation, representative company (RepCo) dividends and equity participation, which ensure that monetary payments are made equitably and transparently to the nuclear family level.

Table 9.8 Management and mitigation measures (cont'd)

Mitigation number	Mitigation title	Mitigation measure
SV2 – Opportunities for participation in the cash economy (cont'd)		
SEM015	Business development, supply and procurement support	Implement the Business Development, Supply and Procurement Plan aligned with the designated preferential zones.
SEM016	Employment and commercial opportunity awareness	Notify communities about proposed employment and commercial participation (business development, supply, procurement) policies and systems, including the designated preferential zones, and ensure that stakeholders have clear and regularly updated information on how to access employment and procurement opportunities.
SEM017	Pre-employment training	Implement pre-employment training for Zone 1 and Zone 2 landowners as far in advance of construction as possible.
SEM018	Contractor development plans	Contractor scope of works and contract conditions will include the development of plans and protocols to comply with Project employment, training and procurement policies. Contractor plans to be assessed and approved by FRL prior to contract award and be subject to regular performance reporting and audit.
SEM019	Income management training	Deliver income management training and advice to local employees and households to assist local people to manage the transition to higher incomes.
SEM020	Women's participation	Implement measures, based on an assessment of demonstrated need and local preference, to support the participation of women in training, employment and business development activities associated with the Project.
SEM021	Livelihood surveys	Undertake a baseline assessment of settlement and livelihoods along road corridors prior to construction. Assess change post-construction as part of Social Management Plan monitoring.
SEM022	Transition to closure support	Manage transition from operation to closure through the progressive development and implementation of a closure plan that addresses key livelihood issues such as employment and service provision.
SEM023	Conflict management	Work with the PNG Government to assist in managing conflict associated with distribution of benefits.
SEM024	Benefit distribution agreements	Establish benefit distribution agreements that encourage the adoption of a benefit stream sustainable wealth strategy which: <ul style="list-style-type: none"> • Includes measures to provide for future generations. • Favours long-term investment over immediate consumption. • Supports vulnerable group members. • Includes on-going feedback to landowning clan members.
SEM025	Local procurement	Encourage the development of local procurement as per the Business Development, Supply and Procurement Plan
SEM026	Local enterprises	Encourage the development of non-mining related local enterprises, such as cash cropping, within Zones 1 and 2.

Table 9.8 Management and mitigation measures (cont'd)

Mitigation number	Mitigation title	Mitigation measure
SV2 – Opportunities for participation in the cash economy (cont'd)		
SEM027	Regional development cooperation	Encourage coordination with the two Sepik provinces and other major impact project developers in the area of agriculture and industry, so that the Project supply and procurement systems, and potential community investment programs, support the broader regional development aspirations and plans.
SEM028	Employment maximisation	Promote employment from Zone 1, Zone 2 and Zone 3 to ensure that wages and benefits accrue to the Sepik regional and urban centres.
SV3 – An enduring ability to sustain cultural identity and traditions including connection to ancestors		
SEM029	CHMP	Implement Cultural Heritage Management Sub-plan and associated Chance Finds Protocol.
SEM030	Cultural heritage induction	Include cultural heritage awareness briefings in workforce inductions, including briefing on individual obligations to protect cultural heritage in accordance with PNG law.
SEM031	Informing cultural heritage custodians	Disseminate information derived from chance finds acquired during the Project to the custodians of cultural heritage and/or the public and National Museum and Gallery (NMAG), where relevant.
SEM032	Support for cultural research programs	Support research programs which document cultural aspects of communities including traditional subsistence practices (e.g., hunting and gardening), language, capturing 'stories' and other cultural aspects.
SEM033	Pre-construction surveys	Conduct engagement with local communities regarding: <ul style="list-style-type: none"> • The content of the Project EMMPs. • The development of culturally appropriate methods for the practical management of cultural heritage values that are to be protected from impacts. • The development of appropriate management measures in relation to their oral tradition sites. Culturally appropriate responses to the management of sites and places that will be unavoidably impacted by Project activities may include avoidance, exhumation/relocation of the value and traditional ceremonies (that should precede the commencement of Project activities in that location).
SEM034	Information on construction impacts	Implement site specific management measures as specified in the Project Cultural Heritage Management Sub-plans.
SV4 – An enduring ability to maintain customary rights to land access and resource use		
SEM035	Develop and implement a Project-Induced In-Migration Management Strategy (PIIMMS)	Develop and implement the Project-Induced In-Migration Management Strategy in collaboration with landowners and provincial and local governments. Ensure that integration with other measures contributing to the management of population movements (e.g., recruitment strategy, contractor compliance with policy, provision of regional infrastructure and services) is coordinated and effective.
SEM036	Land dispute resolution	Collaborate with the PNG Government and support government led processes to resolve land disputes if they arise.

Table 9.8 Management and mitigation measures (cont'd)

Mitigation number	Mitigation title	Mitigation measure
SV4 – An enduring ability to maintain customary rights to land access and resource use ancestors (cont'd)		
SEM037	Membership Qualification Criteria (MQC)	Implement the MQC to codify social and cultural criteria by which each of the three Zone 1 groupings (Telefol, Miyan and Paiyamo) identify membership and from this establish and maintain a database at the nuclear family and individual levels.
SEM038	Land access	Conduct new post-permitting land access in a manner that promotes transparency and the fair treatment of customary landowners in PNG and follows established protocols for landowner identification.
SEM061	In-migration management	Support government initiatives that aim to discourage settlement within road and transmission line easements.
SV5 – An environment amenable to personal and family health, education, safety and security		
SEM039	Capacity building programs	Through a community capacity development program, collaborate with stakeholders and engage vulnerable groups in capacity building programs to develop youth leadership initiatives that support the active role of future generations.
SEM040	Air, noise, vibration management measures	Implement air, noise and vibration management controls in the Project EMMPs.
SEM041	Project emergency response measures	Establish Project Emergency Response and Fire Sub-plans including provisions for community awareness and coordination with District and Provincial authorities.
SEM042	Workforce code of conduct	Develop and implement (commencing with workforce induction training) a workforce code of conduct to guide workplace behaviour and respectful interaction with host communities. As a minimum, this code of conduct will cover: ethics; health; environment; safety; alcohol and drug use; workforce diversity; harassment; and cultural and social sensitivities of workers and communities.
SEM043	Vehicle awareness training	Develop and implement measures including driver education, community risk awareness, operational road traffic management protocols and appropriate physical safety measures (including vehicle-pedestrian separation) where required.
SEM044	Vessel management protocols	Develop and implement measures which include vessel crew education, community risk awareness, operational vessel management protocols, and appropriate physical safety measures (such as visual and audible warnings) where required for construction and operations.
MM144	EMMP measures	Conduct awareness training of the alert and communications system procedures to all potentially affected communities, FRHEP employees and contractors in the unlikely event of an ISF emergency.
SEM046	Workforce health screening	Implement workforce health screening during the recruitment process; on-going workforce health education and awareness programs; and comprehensive employee health service provision in compliance with legislative requirements and company workplace health and safety policies.

Table 9.8 Management and mitigation measures (cont'd)

Mitigation number	Mitigation title	Mitigation measure
SV5 – An environment amenable to personal and family health, education, safety and security (cont'd)		
SEM047	Workforce accommodation	Construct and operate workforce accommodation and messing facilities in accordance with recognised standards for hygiene and safety ³ .
SEM048	Health awareness education	Educate workers on disease prevention and health promotion, and encourage workers to share their learnings with the community.
SEM049	Workforce induction	Implement a Project-wide induction process that covers, as a minimum: ethics; health; environment; safety; alcohol and drug use; workforce diversity; harassment; and cultural and social sensitivities of workers and communities.
SEM050	Security personnel training	Conduct background checks on security personnel and train them in the Voluntary Principles on Security and Human Rights.
SEM051	Infectious disease control	Implement infectious disease management programs for workers, incorporating worker education, to reduce potential for disease occurrence.
MM050	Hazardous materials	Store, handle and transport hazardous substances in accordance with Australian Standards AS1940:2017 and AS3780:2008, and the PNG Environmental Code of Practice for Vehicle/Machinery Workshops and Petroleum Storage/Resale/Usage Sites.
SV6 – The availability of services supportive of personal health, education, safety and security		
SEM054	Health and education programs	In partnership with government and non-government health service providers implement health and education programs, and infrastructure development and delivery of health treatment and prevention services in communities surrounding Project facilities.
SEM056	Community and government justice	Through the Project's community investment programs, actively support and promote initiatives aimed at law and order, community and government justice administration and conflict management initiatives.
SEM057	Grievance Management Procedure	Provide access to an effective and transparent Grievance Management Procedure for communities, employees and contractors.
SEM058	Early conceptual closure planning	Conduct conceptual closure planning as part of Project design to enable design consideration of post closure sustainability of infrastructure and assets.
SEM059	District and Local Level Government	Actively support the five year rolling District and Local Level Government plans within the Zone 1 and 2 host districts.
SEM060	Provincial government coordination	Actively support the Sandaun Provincial Government's 'Growth Centre' strategy, and other provincial and regional development plans.

³ IFC/EBRD (2009) Workers Accommodation: Processes and Standards, A Guidance Note by the International Finance Corporation and the European Bank for Reconstruction and Development, London

9.5 Residual Impact Assessment in Each Social Catchment

This section discusses the residual assessment of impacts to social values described in Section 9.2 for each social catchment (see Figures 7.30, 7.31 and 7.32), following the assumed effective implementation of mitigation measures. Those risks which were assessed as having pre-mitigated significance rating of medium or higher have been assessed in terms of how they may be experienced in each respective social catchment. An impact assessment at a provincial level (Social Catchment 3) has been conducted as a high-level analysis rather than a formal impact assessment, as many of the impacts to social values are covered in greater detail at the local level in Social Catchments 1A, 1B, 1C, 1D and 2. The section provides a summary of the impacts from the combined threats to each social value and highlights key significance ratings. The full assessment of pre- and post-mitigation significance has been provided in Appendix 13.

A health impact assessment (HIA) (Appendix 13) was completed for the Project, the purpose of which was to examine the potential exposure of Project communities to the essential micronutrient metals copper, selenium and zinc, and the contaminant metals arsenic, cadmium, mercury and lead. Potential exposure pathways modelled included drinking water, food, village soils, sediments and surface/recreational water through the ingestion and dermal absorption routes. The air exposure pathway was not modelled as this pathway has been demonstrated to represent an insignificant percentage of the total aggregated exposures in previous PNG studies. However, the air quality modelling results do indicate that during construction fugitive dust management measures may need to be implemented when works are being performed within 800 m of populated areas.

The health impact assessment adopted a standard deterministic health risk assessment method comparing modelled exposure with international standards and guidelines. The assessment included the use of site-specific Project data including:

- Social baseline surveys undertaken for the Project between 2009 and 2017 (Coffey Environments 2009, 2010, 2011, 2015 and Coffey, 2017).
- Baseline Health, Diet and Nutrition Survey (Appendix 13).
- Water Quality and Aquatic Ecology Baseline (Appendix 7a).
- Sediment Transport Assessment (Appendix 5).
- Site-wide Water Balance (Appendix 6a) and Load Balance (Appendix 6b).
- ISF Bioaccumulation and Biomagnification Analyses (Appendix 7b).
- Surrogate data from previous studies of PNG Western Province communities with similar environmental health circumstances as the Project community villages (Bentley 2007a, b).

The HIA considered the potential exposure to communities from metals in the environment, including an assessment of predicted changes due to mine discharges. The dominant exposure pathways to metals in the environment were determined to be food and drinking water pathways. As a conservative approach, the HIA modelled a worst-case scenario in which communities access drinking water from waterways impacted by predicted maximum total metal concentrations, such as the Frieda River. Baseline studies found that villagers access their drinking water from a range of sources including creeks, off-river water bodies, natural springs and tanks and therefore do not source all their drinking water from the Frieda River, hence the HIA conservatively overestimates the exposure from this source. Even with this worst-case scenario, the HIA determined there would be no adverse impacts to human health from this

activity. This includes consumption of fish and wildlife from the potentially impacted areas which are predicted to remain safe to eat. Other Project-related impacts are discussed in further detail for each of the social catchments below.

Air quality modelling (Appendix 11) indicated that the highest potential for air quality impacts (amenity) will be from dust associated with:

- Construction of the infrastructure corridor, which will occur in close proximity to 13 villages comprising Aminii, Vanimu, Dioru, Sumumini, Imbrinis, Kilifas, Green River, Wokomo 2, Itomi, Kwomtari, Hotmin, Bisiabru and Usaremin 2 (all located within 800 m of the proposed road/pipeline alignment).
- Construction of the Vanimu Ocean Port, which will occur in proximity to Vanimu and Wesdeco.

The mine and FRHEP are remote from nearby villages (pending resettlement of Ok Isai, Wabia, Paupe and Wameimin 2 prior to construction) and therefore air quality impacts will not be an issue for these villages.

The following sections provide a summary of the socio-economic impacts to social values in terms of how they may be experienced in each respective social catchment.

9.5.1 Social Catchment 1A: Mine Area

Social Catchment 1A includes the Miyan, Telefol and Paiyamo social sub-catchments and communities. Members of landowning groups for the mine and FRHEP area largely reside in these villages.

Catchment 1A: Miyan Social Sub-Catchment

Wameimin 2 is the village in closest proximity to the mine area and related activities, located approximately 8 km north-west of the mine area and 3 km west-southwest of the Nena deposit. There is no ground disturbance expected upstream of Wameimin 2 and no construction camps in its vicinity. Wameimin 2 will be resettled so that the future population near the Nena deposit will not overly constrain the development of that deposit (where the decision to develop or not will be made at some stage in the future), nor be physically impacted should the deposit be developed. The mine area and ISF will remove access to approximately 13,500 ha of forested land, a significant amount of which was available to Miyan for hunting purposes. The other Miyan villages are located to the west-southwest of Wameimin 2 at distances of 13 to 20 km from the mine area. As such, they will experience no direct physical impact.

In-migration is not expected to be prevalent within the Miyan social sub-catchment. Amaromin may experience some effects of in-migration due to its proximity to the May River which is accessible by canoe from the Sepik River.

Livelihoods - The capacity to support subsistence livelihoods (Social Value 1) and the opportunity to participate in the cash economy (Social Value 2)

It is possible that the capacity of the Miyan people to support subsistence livelihoods will be impacted by the in-migration of people into the social sub-catchment, principally to Amaromin due to its proximity to Fiak, its status as a landowning village, and eligibility to receive Project related financial benefits. Internal population movement toward a relocated Wameimin 2 may result from Wameimin 1 (who have expressed a desire to co-locate with Wameimin 2 to access better services and resolve a land dispute), and potentially from Amaromin and Sokamin. The consequence of population influx on the capacity to support subsistence livelihoods within the Miyan social sub-catchment is moderate, as it will create pressure on land and resources close to

settlements which could lead to a decline in garden productivity if fallow periods are shortened and less land being available for garden production. It will also increase the pressure on hunted animals and aquatic fauna such as fish, though Miyan people during consultation indicated significant undisturbed areas would remain for hunting. The Project will seek to collaborate with landowners and government to manage effects associated with in-migration through implementation of the PIIMMS. The residual significance is assessed as **medium**.

The capacity of the Miyan people to support subsistence livelihoods will also be impacted by physical disturbance from Project activities such as vegetation clearance and inundation of the ISF area which reduces the land available for hunting. The Project will implement comprehensive water monitoring, pre-construction surveys, vegetation clearance planning, and erosion and sediment control to reduce the risk of impacts from physical disturbance to subsistence lifestyles. The residual significance is assessed as **very high**.

While the Project will facilitate access to the cash economy through direct employment, receipt of Project related financial benefits and stimulation of the local economy, there is likely to be a reduction in the number of people from Miyan villages able to access formal employment when the Project transitions from construction to operations, as there will be less demand for unskilled labour, and this will affect their ability to participate in the cash economy. There are currently only a small number of people in the Miyan social sub-catchment who possess the skills and experience required to access operational employment, however this will be mitigated by developing and implementing a training and employment plan to up-skill local people. The consequence of not gaining employment which was expected will be moderate, as it may lead to alienation and social unrest due to not obtaining expected income, compounded by the observance of outsiders perceived to be benefiting from employment. The Project will implement training and capacity building initiatives for Project employees to facilitate transition from wage employment. The residual significance is assessed as **medium**.

Culture - An enduring ability to sustain cultural identity and traditions (Social Value 3) and maintain customary rights to land access and resource use (Social Value 4)

While cultural identity is currently robust with little significant external engagement other than church activity and schooling due to remoteness, villagers display a pragmatic attitude to the potential for Project related interference to archaeological and cultural heritage sites and acceleration of cultural change. Nonetheless, due to the scale of the Project and its potential transformative social effects, it is likely that the Project will impact cultural identity and tradition within the Miyan social sub-catchment. The intensity and duration of the Project, which facilitates changes of lifestyle across generations, may inhibit a return to traditional practices following mine closure, assuming there remains a desire to do so. The Project has limited capacity to manage processes of social change, particularly when such change is sought by communities themselves. The Project will seek to ensure that the cultural identity of the Miyan is duly recognised and respected through a workforce induction which includes cultural awareness briefings. The support of programs to sustain culture, including traditional subsistence practices (e.g., hunting and gardening), language protection and promotion, and the documentation of 'stories' and other features of culture will also be considered. Following the application of management measures the residual significance is assessed as being **medium**.

It is certain that the Project will indirectly influence the status of traditional leadership due to increased exposure to non-traditional forms of knowledge and lifestyles. Ensuing social change has the potential to alter current traditional leadership structures which can have an adverse effect on community governance. Evidence from other mines in PNG indicates that there is the

potential for disagreements that may act to polarise groups in the community making it difficult to achieve consensus on the management of issues that affect the broader community (Jackson, 2012). The Project will seek to support a community leadership initiative to assist village leaders in managing the expectations of community members regarding village justice systems, traditional leadership and authority structures in interactions with villagers. With the application of such measures, adverse effects on the exercise of traditional leadership will have minor consequences and the residual significance is assessed as **medium**.

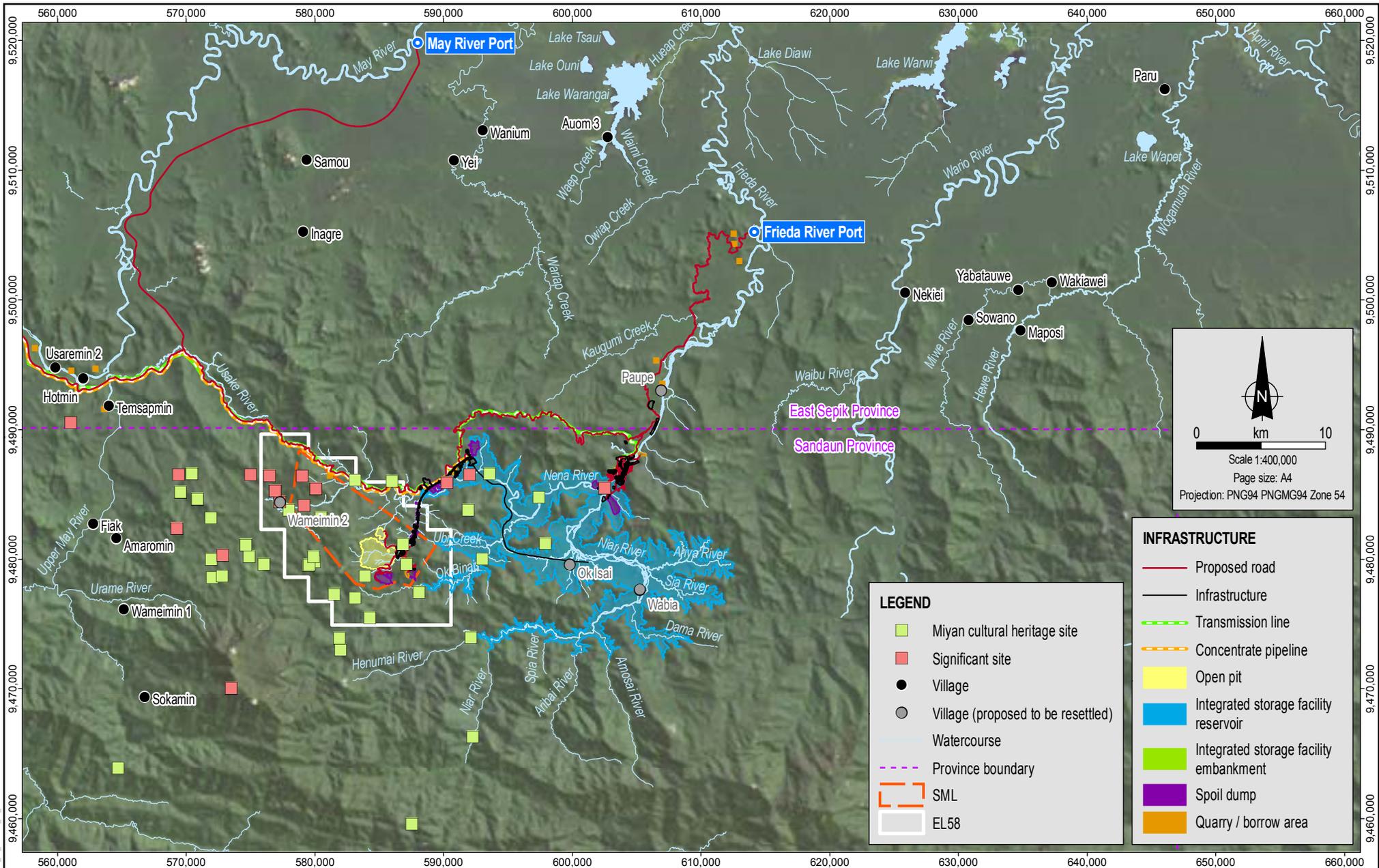
It is possible the rights of the Miyan to land and resource use may be placed under pressure because of in-migration to Amaromin and possibly Wameimin 2, as well as by disruption to traditional leadership. In collaboration with government and landowners, the PIIMMS will be implemented to manage the impacts of population influx on Miyan social sub-catchment community. This will include measures to support landowner communities to maintain customary rights to land access and resource use. Nevertheless, an increase in population may have a moderate impact on Miyan social sub-catchment communities' ability to maintain customary rights and practices and the residual significance is assessed as **medium**.

Project disturbance will impact on Miyan cultural heritage sites and will need to be managed to ensure that significant cultural heritage sites are avoided or the disturbance of them is appropriately compensated. Figure 9.1 shows cultural heritage sites that may be impacted by Project activities. The Project Cultural Heritage Baseline and Impact Assessment study (Appendix 13) identified a total of 66 cultural heritage sites within the Miyan social sub-catchment, many of which combine to form composite site typologies at a single location. A Cultural Heritage Management Plan will be implemented during the construction phase to protect cultural heritage sites or ensure appropriate compensation. Therefore, it is unlikely that the Miyan people's ability to sustain their cultural identity will be impacted by Project disturbance to cultural heritage sites. The consequence of damaging or destroying a cultural heritage site is moderate, as the loss of physical sites connected to important stories may contribute to an erosion of cultural knowledge and sense of place. The residual significance is assessed as **medium**.

Personal and community well-being - An amenable environment (Social Value 5) and the availability of services supportive of personal health, education, safety and security (Social Value 6)

It is possible the in-migration of people to the Miyan social sub-catchment will induce social tensions as conflicts develop because of increased social interaction, as has happened with other mining projects in PNG. The safety and security of residents may therefore be compromised. To manage this impact the Project will partner with government and non-government health service providers to implement community health education and awareness programs, and support the legitimacy of community and government justice administration and conflict management initiatives, to sustain a stable and safe environment, particularly for women, children and those who are vulnerable. An increase in population may have a moderate consequence on the safety and security of residents in Miyan social sub-catchment villages. The residual significance is assessed as **medium**.

The entitlement to Project financial benefits is likely to impact on the stability of villages in the Miyan social sub-catchment as the negotiation of the distribution of rightful benefits potentially invokes division, inequality and conflict within and between communities. The Project proposes to address this situation through the provision of pre-employment training in literacy and numeracy for residents as far in advance of construction as possible and the implementation of measures to support the participation of women in training, employment and business development activities



LEGEND

- Miyan cultural heritage site
- Significant site
- Village
- Village (proposed to be resettled)
- Watercourse
- Province boundary
- SML
- EL58

INFRASTRUCTURE

- Proposed road
- Infrastructure
- Transmission line
- Concentrate pipeline
- Open pit
- Integrated storage facility reservoir
- Integrated storage facility embankment
- Spoil dump
- Quarry / borrow area

MXD Reference: 11575E_15_GIS007_v0_3

Source:
 Cultural heritage sites from ALA.
 Infrastructure, roads and tenements from FRL.
 Villages, topographic features, watercourses and water bodies from FRL and Coffey.
 Provinces from NMB.
 Landsat satellite imagery from FRL (capture date unknown). Hillshade DEM from SRTM.



Date: 14.09.2018
 Project: 754-ENAUABTF11575B
 File Name: 11575_11_F09.01_GIS

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Location of Miyan cultural heritage sites identified in Social Catchment 1A

Figure No: 9.1

associated with the Project. FRL will also look to support benefit distribution agreements which encourage the adoption of a benefit stream sustainable wealth strategy which includes measures to provide for future generations, favours long-term investment over immediate consumption and supports vulnerable group members. The PIIMMS will include a leadership support initiative to assist clan leaders in managing expectations and the response to demands for access to Project benefit streams from their broader social networks. Following the application of such measures, issues associated with entitlement to benefits will have a minor consequence. The residual significance is assessed as **medium**.

It is possible that community members interacting with Project workers from other areas of PNG and beyond will experience higher levels of morbidity and STI and HIV infections which will subsequently be spread to other members of the community. In response to this potential impact the Project will develop and implement community health education and awareness programs, and support the delivery of disease treatment and prevention services by third parties. Implementation of these measures will reduce the likelihood from likely to possible. The residual significance is assessed as **medium**.

Increased disposable income and the presence of outsiders can increase the general availability of drugs and alcohol and can lead to men taking more wives and prostitution. This can lead to decreased security for women and children and an increase in inter-personal violence. There may also be violence and other forms of inappropriate behaviour by Project workers or security personnel. In response, the Project will support community capacity to develop and sustain an environment conducive to the physical, spiritual and emotional well-being of its members, in particular women, children and those who are vulnerable, to reduce the impact to the social value. It is possible that the impact will occur in Miyan social sub-catchment villages and the consequence of decreased security and increased violence is moderate. The residual significance is assessed as **medium**.

There are likely to be high levels of expectation in landowner communities such as the Miyan that the Project development will lead to much improved service provision, particularly in health and education. Any delay or non-provision of these services will lead to community disappointment and tension, notwithstanding any poor performance by government or other service providers. The Project proposes to work in partnership with government and non-government health service providers to implement community health, education and awareness programs, and support the improvement of infrastructure. Following the application of such measures the issues associated with unrealised service delivery expectations will have a moderate consequence. The residual significance is assessed as **medium**.

Catchment 1A: Telefol Social Sub-Catchment

The Telefol social sub-catchment, comprising Ok Isai and Wabia villages, is in the Niar River catchment. Because of the ISF, both villages will be required to relocate to an area mutually agreed through the resettlement planning process. This location is yet to be determined. While this process has commenced, the identification of location options for new villages is currently under discussion with both village communities. Options are expected to include sites on recognised Telefol land not requiring land acquisition, as well as a potential site on customary land of other landowning groups that will require Government acquisition to ensure security of tenure.

What is clear is that the reservoir will alienate most Telefol land and watercourses currently used for subsistence food production, alluvial gold mining and transport access, with resettlement requiring a substantial program of livelihood restoration initiatives. Telefol are in the Zone 1

employment category and participation in the mine and contractor workforces, following required training and skills acquisition, will constitute a major avenue for livelihoods in the future.

Flexibility in resettlement site planning should ensure that the resettled villages do not experience any impaired amenity through noise, vibration or air emissions associated with Project construction and operation, while having access to an improved level of infrastructure, such as road access, water supply and sanitation facilities. Alluvial gold mining areas in the upper reaches of the Niar River and Ok Binai are still expected to be available to the Telefol to support livelihood activity, assuming the Telefol choose to access the areas via land due to lack of access via the ISF.

It is expected that there will be some level of pressure to host Telefol in-migrants seeking access to benefits from the Project because both villages have strong cultural links to the Telefomin and Eliptaman areas, approximately 30 km to the south, and Ok Isai has experienced outside settlers in the past seeking employment or access to alluvial gold areas.

Livelihoods - The capacity to support subsistence livelihoods (Social Value 1) and the opportunity to participate in the cash economy (Social Value 2)

The Telefol will experience significant disruption to current subsistence livelihood activity (gardening, hunting and fishing), though it is acknowledged that there is a current high level of reliance on imported food due to the cash economy associated with alluvial gold mining. The restoration of subsistence livelihood activity, should it be desired, will be dependent on the suitability of new village sites and access to land with adequate land use capability at those sites. The importance placed on future subsistence livelihood activity (Social Value 1) will be dependent on the dominant form of livelihood activity pursued, which is likely to be mine wage employment for those capable. This indicates that close attention will need to be given to vulnerable villagers in the resettlement locations who will likely not be able to secure this employment and who may not receive income through royalty payments. Telefol land will remain available south of the ISF though this may be harder to access for vulnerable households should the resettlement sites be located remote from that land. The likelihood of these impacts occurring is almost certain with moderate consequences indicating a **high** level of significance.

The ability to engage in alluvial gold production will likely be highly constrained should sites be distant from resettled villages and access across the ISF will be restricted for safety reasons. The returns to labour from alluvial mining will also be compared to incomes able to be derived from mine wage employment, which will influence the level of engagement in this activity after construction of the mine begins. While the impact is almost certain, the consequences will be moderate due to the alternative income sources available and compensation that will be paid for the alienation of the resource, indicating a **high** level of impact. There will be some potential for community resentment towards the Project due to the expected significant employment loss between construction and operational phases of the Project. While new village locations will have access to the road corridor to Vanimo, this is not expected to stimulate any cash crop agricultural production due to land availability and suitability constraints, and the inability to compete with mine-derived employment income.

There will be potential for positive impact from opportunities to derive income through business development and operation in the mine supply chain, as well as potential for investment of royalty flows in commercial activities elsewhere (such as in Vanimo).

Culture - An enduring ability to sustain cultural identity and traditions (Social Value 3) and maintain customary rights to land access and resource use (Social Value 4)

It is possible that the Project will impact on cultural identity and traditional leadership within the Telefol social sub-catchment as the Telefol villages will need to be resettled, entailing land loss and significant changes to livelihood activity. There is a high level of cultural self-confidence amongst the Telefol, a reflection of which is seen in the pursuit of their rights to land in the Project area over more than 30 years. This, combined with an active alluvial gold industry and the relocation of villages to their current sites in the early 1990s to be closer to mine exploration and development activity, indicates that the Telefol have pursued economic opportunity and managed associated cultural change. As such cultural and traditional leadership may well evolve in different ways during the life of the Project.

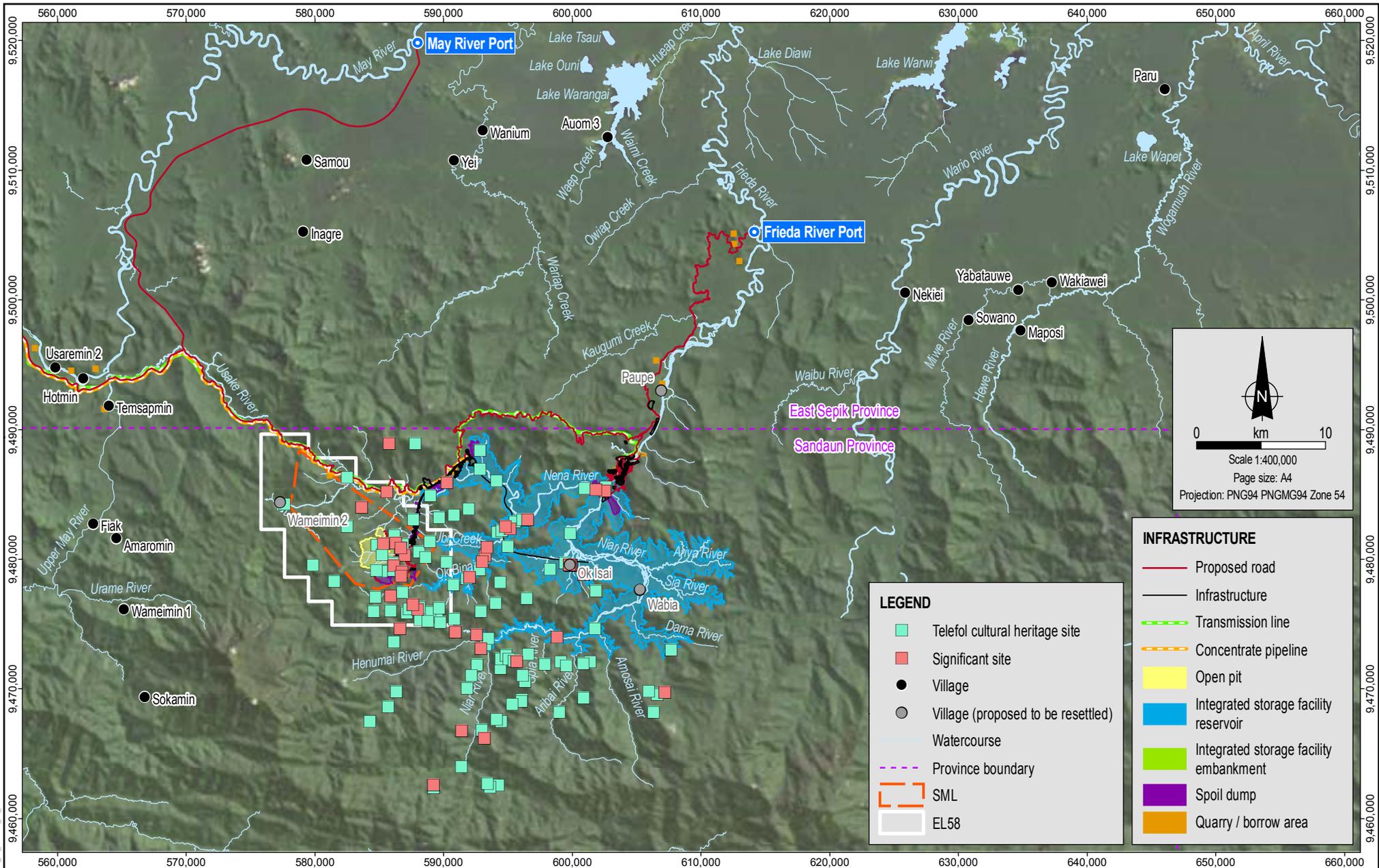
However, a deeper immersion in the mainstream economy is likely to influence perspectives on identity, especially for the next generation of clan members. The Project will work with communities to develop and implement programs to respect and sustain language and culture. Despite these factors, the likely proximity of the Project to resettlement villages, the scale of the Project and the transformative effects which are likely to result, mean that there will be ongoing effects on cultural identity and sense of place through the life of the project.

It is possible that social organisation and customary rights to land and resource use may be affected by in-migration (both to resettled villages and to Telefol land not subject to inundation, though this is considered less likely). The Project, in collaboration with government and landowners, will seek to limit the movement of people onto customary lands through the development and implementation of the PIIMMS. The plan will include measures to protect customary rights to land, such as lease boundary monitoring, and partnerships with respective landowners to police the incursion of migrants onto customary lands. An increase in population may affect Telefol social sub-catchment communities' use of land and associated resources in the immediate vicinity of the Project.

Project disturbance will impact on cultural heritage within the Telefol social sub-catchment and will need to be managed to ensure that significant cultural heritage sites are avoided or the disturbance of them is appropriately compensated. Figure 9.2 shows cultural heritage sites that may be impacted by Project activities. The Project Cultural Heritage Baseline and Impact Assessment study (Appendix 13) identified a total of 142 cultural heritage sites within the Telefol social sub-catchment with typical sites including spiritual (*masalai*), oral tradition and settlement sites. A Cultural Heritage Management Plan will be implemented during the construction phase to protect cultural heritage sites and ensure appropriate management, and compensation for, sites that cannot be avoided. Therefore, it is not expected that the Telefol people's ability to sustain their cultural identity will be impacted by Project disturbance to cultural heritage sites. The loss of physical sites connected to important stories, through damage or destruction, may contribute to an erosion of cultural knowledge and sense of place. The residual significance is assessed as **medium**.

Personal and community well-being - An amenable environment (Social Value 5) and the availability of services supportive of personal health, education, safety and security (Social Value 6)

The potential for impairment of community well-being is highly dependent on the effectiveness of the resettlement planning and implementation process, and the success of the livelihood restoration support initiatives. This process aims to be highly participative and, to gain villager



MXD Reference: 11575E_15_GIS008_v0_3

Source:
 Cultural heritage sites from ALA.
 Infrastructure, roads and tenements from FRL.
 Villages, topographic features, watercourses and water bodies from FRL and Coffey.
 Provinces from NMB.
 Landsat satellite imagery from FRL (capture date unknown). Hillshade DEM from SRTM.



Date: 14.09.2018
 Project: 754-ENAUABTF11575B
 File Name: 11575_11_F09.02_GIS

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Location of Telefol cultural heritage sites identified in Social Catchment 1A

Figure No: **9.2**

agreement on the resettlement site, will address security of tenure and initiatives for the replacement of housing, infrastructure, service provision and livelihood restoration. While it is not expected that the resettlement villages will be subject to any environmental impacts from Project construction and operations, they will be provided with road access that will link to the public road from Hotmin to Vanimo. The maintenance of social cohesion (both within and across language groups) following resettlement will be important as, in times of community stress, historical animosities have a tendency to surface and disrupt relations – notwithstanding the recent surfacing of apparent divisions between Ok Isai and Wabia which require further investigation to understand. Supported community development programs will focus on leadership, problem solving and conflict resolution, and will be implemented in partnership with non-government organisations, such as the Baptist Church, trusted by Telefol. The Project will provide support for community and government justice administration and seek to partner with government and non-government development agencies to sustain stable and safe living environments, particularly for women, children and those who are vulnerable.

Personal and community well-being will be influenced by the interactions which Telefol villagers have with neighbouring communities (potentially including in-migrants) and the Project workforce. There is the possibility for such interaction to result in an increase in the availability and consumption of alcohol (or drugs) or higher risk sexual behaviour which can result in social unrest and law and order issues along with negative health outcomes. The Project will support village justice systems and develop and implement a workforce code of conduct and induction process to guide workplace behaviour and respectful interaction with host communities. However, there remains a possibility of such impacts occurring, the consequences of which are moderate. The residual significance is assessed as **medium**.

Disparities in income due to non-uniform participation in Project opportunities and the receipt of Project benefit entitlements may invoke division, inequality and conflict within and between communities, and potentially result in the use of force to resolve issues, which would impact on community safety within the resettled communities of Ok Isai and Wabia. The Project proposes to address this situation through the provision of pre-employment training in literacy and numeracy for residents as far in advance of construction as possible and the implementation of measures to support the participation of women in training, employment and business development activities associated with the Project.

Plans for service provision (including the sustainable financing of such service provision) will be developed in collaboration with the local level and provincial government during the resettlement planning process and considered for inclusion in agreements negotiated during the Development Forum process.

Catchment 1A: Paiyamo Social Sub-Catchment

The Paiyamo social sub-catchment area is centred on Paupe village. Paupe is the closest village downstream of the hydroelectric power facility (approximately 5 km) and 2 km downstream from the existing Frieda River airstrip. Paupe is also adjacent to the planned FRHEP access road. Hence, Paupe in its current location will be impacted by construction traffic for the duration of the construction period and will host a construction camp close to the existing airport site. Construction activity associated with the mine and FRHEP upstream from Paupe will, at times, increase the turbidity and sediment load of the Frieda River, while road construction activity has the potential to interfere with natural springs that communities rely on for water.

In consultation undertaken as part of the SIA, residents from Paupe expressed a high level of concern for the aquatic environment and anxiety concerning the potential for river pollution should

the structural integrity of the ISF embankment be compromised, or due to spillage of chemicals or fuels which are not contained during construction and operations, and which subsequently enter the Frieda River system. Due to these concerns, and the intense construction activity in proximity to the village, it was agreed that the village would be relocated, likely to a site in the upper Kaugumi Creek catchment.

Substantial in-migration pressure is still expected to occur in the relocated Paupe village due to its direct access to the Sepik River and Frieda River airstrip.

Livelihoods - The capacity to support subsistence livelihoods (Social Value 1) and the opportunity to participate in the cash economy (Social Value 2)

It is certain that resources currently available to the Paupe residents to support livelihoods (including forest in the Nena valley and aquatic resources in the Frieda River) will be impacted directly by the construction and operation of the Project (FRHEP access road and embankment construction, road operations, airstrip construction and operations, and water quality impairment) and that this could reduce their capacity to support subsistence livelihoods. Fair and equitable compensation will be provided regarding Project-related impacts on subsistence resource use and an agricultural livelihood security program will be implemented if required. Following application of mitigation measures, and due to large areas of land available for subsistence purposes that will not be impacted, particularly in the Kaugumi Creek catchment the consequence of losing available hunting land is moderate and the residual significance has been assessed as **medium**.

When flows from the ISF reservoir are regulated through the hydroelectric power facility for power generation, flows in the Frieda River will be highly modified compared to baseline flows. While average flow in the Frieda River will remain largely unchanged throughout the mine life, there will be much less variability in flow; low flows will be much higher and high flows will be much lower compared to baseline flows. As described in Section 8.5, residual impacts on freshwater ecology (and available freshwater resources) in the upper Frieda River during operations are assessed as minor. Impacts on aquatic ecology of the lower Frieda River during operations are assessed as negligible.

Aquatic resource use in the Frieda River is likely to be affected during construction prior to impoundment of the ISF for a period of 2 years (Year -4 to Year -2) as a result of TSS concentrations elevated above background concentrations. Flows during this period will not be affected substantially by Project activities.

Once the ISF is impounded in Year -2, TSS concentrations reduce to comparable background concentrations and impacts on aquatic resources in the Frieda River are not expected. The villagers of Paupe have a moderate livelihood dependence on the Frieda River and are likely to still use it for resources following resettlement. Therefore, to assist in mitigation of potential impacts on subsistence production from aquatic resource use, fish stocks and local harvests will be monitored at select locations prior to construction, at regular intervals during construction, and six months post construction. An operational response will be developed if surveys indicate Project impairment of local harvest outside the predictions of the EIS and the Project's environment permit. Therefore, there is expected to be a **medium** residual significance associated with impacts on subsistence resource production during construction. During operations, impacts in the Frieda River on aquatic resources are not expected.

It is expected that a moderate to high level of in-migration may occur at the relocated Paupe village, with people likely to arrive from Auom 3 and Iniok and from nearby Sepik villages who have used Paupe as a staging post when seeking exploration program employment in the past.

Residents from further down on the Sepik River may also seek to relocate to Paupe in search of work, based on a perception that closeness to the Project may provide a higher likelihood of recruitment and access to other forms of economic opportunity. Such in-migration will likely place pressure on the availability of subsistence resources currently relied upon to support livelihoods. The Project will seek to collaborate with landowners and government to manage effects associated with in-migration through implementation of the PIIMMS, as well as restricting Project employees from engaging in hunting or forest harvest activities while on Project sites. The consequences for the availability of subsistence resources will be moderate and the residual significance is assessed as **medium**.

It is likely that the availability of business opportunities will attract experienced business operators from outside the Paiyamo social sub-catchment to establish operations in the area, either with the permission of landowners or in some form of partnership with them. The influx of entrepreneurs may serve to inhibit the ability of residents to capture available business opportunities and limit the development of local enterprises, assuming that they desire to engage in business when there is likely to be significant wage employment opportunities. The Project will establish a Business Development Office and commence the development and implementation of priority business development and support programs for landowners well in advance of Project construction. This will serve to reduce the likelihood of local vendors being outcompeted by outside interests to likely. The residual significance is assessed as **medium**.

Culture - An enduring ability to sustain cultural identity and traditions (Social Value 3) and maintain customary rights to land access and resource use (Social Value 4)

As with all mine area villages, Paupe value their distinct culture but acknowledge the inevitability of on-going change that may accelerate with the advent of Project development. As a small group, leadership is generally cohesive though there is a high level of concern for the consequences of uncontrolled in-migration and an expressed need for law and order assistance to address management of the issue.

As per the Miyan and Telefol social sub-catchments, it is likely that Project development (and the related increased level of monetary wealth) will impact on cultural identity and traditional practices within Paupe. The Project will seek to support local cultures through the avoidance and protection of sites of cultural significance and look to implement programs to respect and sustain culture including traditional subsistence practices (e.g., hunting and gardening), language protection and promotion, and documenting 'stories' and other aspects of culture, as identified by community representatives. However, a substantial degree of cultural change is likely over the medium term.

It is likely that in-migration to villages in the Paiyamo social sub-catchment will affect people's ability to maintain customary rights and practices relating to access to land and resources use. The Project will seek to minimise the movement of people onto customary lands through the development and implementation of the PIIMMS in collaboration with landowners and government. The plan will include measures to preserve the capacity of affected communities to maintain customary rights to land access and resource use, and to exclude migrants from the vacated former village site. In-migration will have moderate consequences on Paupe's ability to maintain customary rights and practices and the residual significance is assessed as **medium**.

Project land disturbance will almost certainly impact on cultural heritage sites and will need to be managed to ensure that significant cultural heritage sites are avoided or the disturbance of them is appropriately compensated. The Project Cultural Heritage Baseline and Impact Assessment study (Appendix 13) identified a total of 43 cultural heritage sites within the Paiyamo social sub-

catchment (Figure 9.3). For the Paiyamo, the most significant sites, and the ones that they do not wish to see disturbed, are indicated to be landforms associated with various *masalai* spirits, who regulate the Paiyamo world-order, ossuaries containing the bones of ancestors and mountains that house the spirits of the dead. Therefore, higher priority will be given to the management of these site types. Cultural heritage pre-construction surveys will be undertaken to identify cultural heritage sites within the vicinity of the FRHEP access road alignment and embankment location and a Cultural Heritage Management Plan will be implemented during the construction phase to protect cultural heritage sites or ensure appropriate compensation. Therefore, it is not expected that the Paiyamo people's ability to sustain their cultural identity will be impacted by Project disturbance to cultural heritage sites. The effects of damaging or destroying a cultural heritage site are material, as the loss of physical sites connected to important stories may contribute to an erosion of cultural knowledge and sense of place. The residual significance is assessed as **medium**.

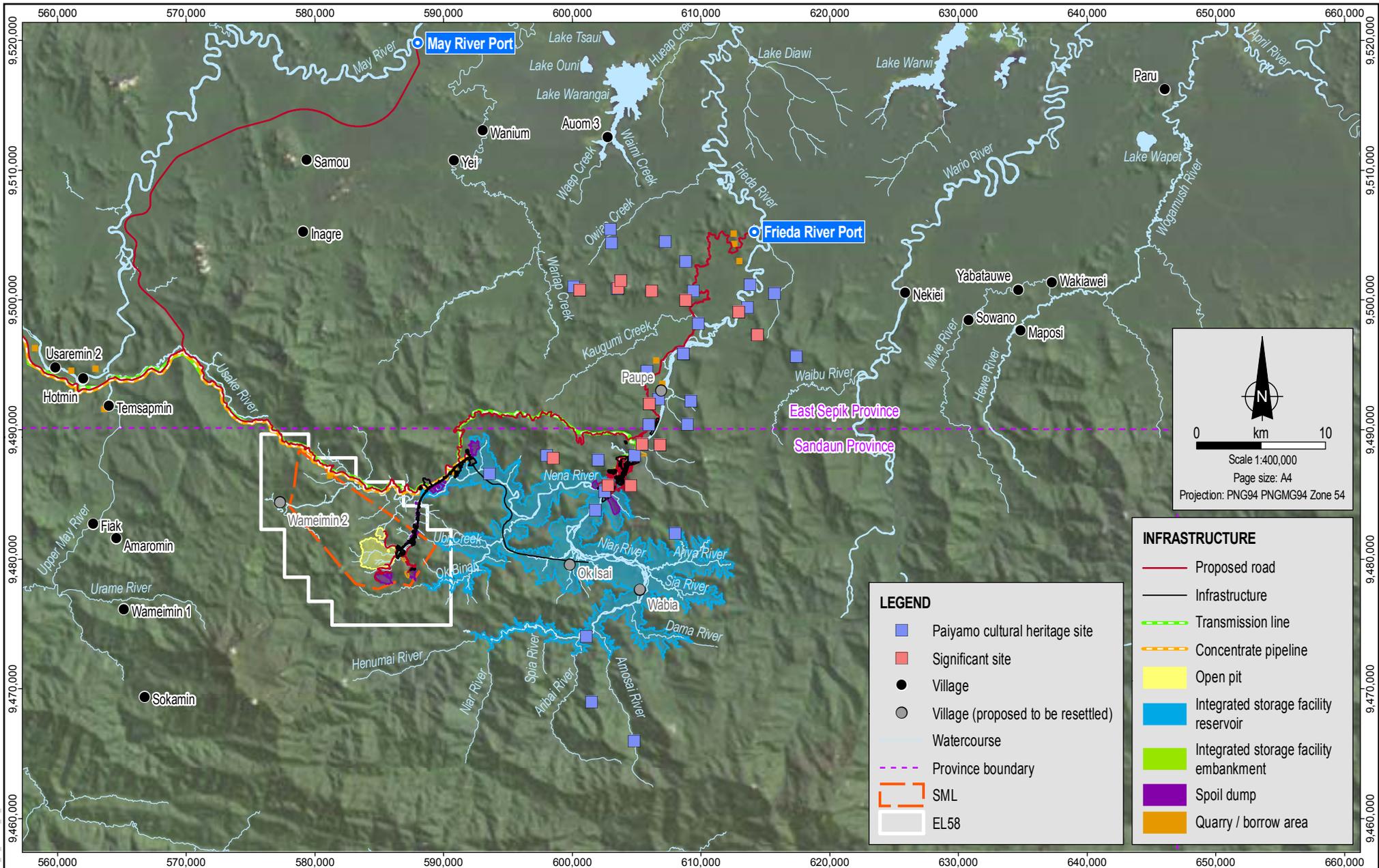
Personal and community well-being - An amenable environment (Social Value 5) and the availability of services supportive of personal health, education, safety and security (Social Value 6)

While residents of the relocated Paupe village are likely to continue to use the Frieda River for fishing and swimming from time to time, the HIA, drawing upon the water quality and bioaccumulation studies (see Appendices 7a and 7b), indicates this will not pose a health risk.

As with other mine area villages, personal and community well-being will be influenced by interactions with the Project workforce, the manner in which high levels of personal income are used and the behaviour that accompanies that use. To manage these impacts, the Project will develop and implement (commencing with workforce induction training) a workforce code of conduct to guide workplace behaviour and respectful interaction with host communities. It will also partner with government and non-government health service providers to implement community health education and awareness programs, and support the legitimacy of community and government justice administration and conflict management initiatives. Following the implementation of such measures the residual significance is assessed as **medium**.

Disparities in income due to non-uniform participation in Project opportunities and the receipt of Project benefit entitlements may invoke division, inequality and conflict within and between communities, and potentially result in the use of force to resolve issues, which would impact on community safety within Paupe. The Project proposes to address this situation through the provision of pre-employment training in literacy and numeracy for residents as far in advance of construction as possible and the implementation of measures to support the participation of women in training, employment and business development activities associated with the Project. In addition, the Project seeks to partner with government and non-government development agencies in supporting community capacity and well-being, for women, children and those who are vulnerable. These measures will reduce the consequence to community health and safety to minor. The residual significance is assessed as **medium**.

People within Paupe have significant concerns regarding Project effects on the environment and particularly on water quality. These concerns are almost certain to persist despite the EIS technical studies indicating that water will remain safe to drink and fish will remain safe to eat. Communities will be briefed on the predicted Project impacts on the downstream environment.



LEGEND

- Paiyamo cultural heritage site
- Significant site
- Village
- Village (proposed to be resettled)
- Watercourse
- - - Province boundary
- - - SML
- EL58

INFRASTRUCTURE

- Proposed road
- Infrastructure
- - - Transmission line
- - - Concentrate pipeline
- Open pit
- Integrated storage facility reservoir
- Integrated storage facility embankment
- Spoil dump
- Quarry / borrow area

MXD Reference: 115756_15_GIS009_v0_3

Source:
 Cultural heritage sites from ALA.
 Infrastructure, roads and tenements from FRL.
 Villages, topographic features, watercourses and water bodies from FRL and Coffey.
 Provinces from NMB.
 Landsat satellite imagery from FRL (capture date unknown). Hillshade DEM from SRTM.



Date: 14.09.2018
 Project: 754-ENAUABTF11575B
 File Name: 11575_11_F09.03_GIS

Frieda River Limited
Sepik Development Project



Location of Paiyamo cultural heritage sites identified in Social Catchment 1A

Figure No: **9.3**

However, due to their location with respect to the mine area, it is still possible that there will be community anxiety regarding the environmental integrity of waterways including the structural integrity and safety of the ISF and the potential for increased sediment loads and introduction of contaminants. While relocation to the upper Kaugumi Creek catchment may help to address concerns relating to the structural integrity of the ISF, the Project is committed to maintaining an active presence in Paupe to address concerns about the environmental integrity of the waterways. While the heightened level of community anxiety is likely to dissipate over time, it may nevertheless remain at a low level during operations and post-closure.

The interaction of local populations with vehicles driving along the FRHEP and mine access roads may pose a safety risk for people who reside in Paupe, notwithstanding the location of the resettled village. People crossing and walking along roads will be vulnerable and it is possible that accidents may occur considering the volume of traffic during construction coupled with the unfamiliarity of residents with road transport. The Project will develop and implement driver education, community risk awareness, operational protocols, and appropriate physical safety measures (including vehicle-pedestrian separation and visual/audible warnings) where required to reduce the likelihood of occurrence. Vehicle collisions with pedestrians have the potential to cause serious injury and fatalities. Therefore, the consequence of an increase in accident trauma is critical and the residual significance is assessed as **high**, indicating the requirement for on-going attention to traffic safety awareness during operations.

Overview - Social Catchment 1A

Of the three social sub-catchments which constitute Social Catchment 1A: Mine Area, the assessment has identified that the Telefol social sub-catchment will experience the highest level of impact due to inundation of the Ok Isai and Wabia villages by the ISF and their necessary relocation, followed by the Paiyamo social sub-catchment due to the proximity of construction activity and the need for resettlement.

Across all three social sub-catchments the primary causes of social change attributable to the Project relate to the disturbance of resources used to support subsistence livelihoods, the social effects associated with access to cash incomes and the transition to a cash based economy, the re-establishment of livelihoods following resettlement, and impacts caused by in-migration. Across Social Catchment 1A, the greatest loss of resources used for subsistence purposes will occur in the Telefol social sub-catchment, due to land inundation, and the Paiyamo social sub-catchment, particularly with respect to potential effects on water quality throughout construction due to its location downstream from the mine area, noting that the findings of the HIA predict that the Project will not increase the risk of impacts to human health.

The Paiyamo social sub-catchment is also predicted to encounter substantial in-migratory pressure due to Paupe's location close to Project infrastructure and physical accessibility. In addition to these factors, Paupe residents may also experience impacts associated with Project traffic and transport activity should they engage in activity in proximity to the FRHEP and mine access roads and Frieda River Port. The combination of impacts predicted to occur across all Social Catchment 1A communities, and particularly in the Telefol and Paiyamo social sub-catchments due to village resettlement, will place significant pressures on social values which will require the effective implementation of proposed mitigation measures, along with external support and partnerships, to ensure effective management.

Table 9.9 presents the residual risks with medium or higher significance ratings for Social Catchment 1A.

Table 9.9 Residual Risks for Social Catchment 1A

Threat	Impact	Language Group	Phase	Likelihood/ consequence	Risk rating
SV1 - The capacity to support subsistence livelihoods					
Vegetation clearance and/or land inundation reduces the availability of food for hunting, catching or gathering	Inadequate supply of subsistence resources from hunting and gathering	Miyan, Telefol	C	Almost certain / major	Very high
		Paiyamo		Almost certain / moderate	Medium
Project development reduces the availability of land for gardens	Inadequate supply of subsistence resources from gardening	Telefol	C	Almost certain / major	Very high
		Paiyamo		Likely / moderate	Medium
Construction earthworks interferes with existing water supplies	Pollution of water affects drinking water and food sources such as gardens or aquatic resources	All	C	Possible / moderate	Medium
Reduced availability of subsistence produce	Elevated dependence of store food	Telefol, Paiyamo	C, O	Likely / minor	Medium
Reduced access to food through gardens, hunting and foraging activities	Elevated dependence of store food	Telefol, Paiyamo	C, O	Likely / minor	Medium
Obstructed access to resources (including alluvial gold) and alienation from traditional lands	Reduced ability to support subsistence livelihoods	All	C	Almost certain / moderate	High
Earthworks associated with road construction and extraction of construction water compromise clean water supplies	Health impairment through drinking contaminated water	All	C	Possible / moderate	Medium
Absence of male labour for farming or gardening activities due to Project employment	Reduction in the availability of food from gardens	All	C, O, PC	Unlikely / moderate	Medium
Absence of female labour for farming or gardening activities due to Project employment	Reduction in the availability of food from gardens	All	C, O, PC	Unlikely / moderate	Medium
Project discharge / emissions that exceed guidelines and / or inappropriate waste disposal pollutes land and / or water resources	Food sources are affected by pollution of land and / or water resources	All	C	Unlikely / moderate	Medium
Project accidental spills or leaks pollute land and / or water resources	Food sources are affected by pollution of land and / or water resources	All	C, O	Possible / moderate	Medium

Table 9.9 Residual Risks for Social Catchment 1A (cont'd)

Threat	Impact	Language Group	Phase	Likelihood/ consequence	Risk rating
SV1 - The capacity to support subsistence livelihoods (cont'd)					
Population growth due to in-migration placing pressure on land used to support gardens which reduces garden productivity	Reduced ability to lead subsistence livelihoods	Miyan, Telefol	C, O	Unlikely / moderate	Medium
		Paiyamo		Likely / moderate	Medium
Population growth due to in-migration resulting in greater demand and subsequent scarcity of terrestrial and aquatic resources	Reduced ability to support subsistence livelihoods	Miyan, Telefol	C, O	Unlikely / moderate	Medium
		Paiyamo		Likely / moderate	Medium
In-migration and an increase in earning capacity puts pressure on land and resources and results in increased cost of store bought and market food	Reduced opportunity for people to purchase food, and insufficient dietary intake, which leads to an increased reliance on subsistence lifestyles	Miyan, Telefol	C, O	Possible / moderate	Medium
		Paiyamo		Likely / moderate	Medium
The ongoing regular availability of increased levels of cash allowing people to purchase items such as guns and traps which will enhance the effectiveness of hunting practices and lead to overharvesting	Reduction in the availability of terrestrial fauna for subsistence purposes	Paiyamo	C, O	Almost certain / minor	Medium
SV2 - Opportunities for participation in the cash economy					
Land use change and loss of land associated with Project works reduce the availability of land to grow cash crops.	Inadequate land to support cash crops and access the cash economy	Telefol	C, O, PC	Almost certain / negligible	Medium
Reduced income from alluvial gold due to sterilisation from inundation	The FRHEP will sterilise the majority of alluvial gold areas currently accessed by near-Project communities, which will reduce income	All	C, O, PC	Almost certain / moderate	High
Limited river trade due to restricted river usage and access	Reduced income through trading	Telefol, Paiyamo	C	Almost certain / minor	Medium
Increased access provided by road construction leads to increased business competition	Reduced opportunity for business activity and income not realised due to increased business competition	All	C, O, PC	Likely / minor	Medium
Reduction in local employment opportunities when Project transitions from construction to operation, and when FRCGP transitions from operation to closure	Loss employment leads to social unrest	All	C, O, PC	Likely / moderate	Medium

Table 9.9 Residual Risks for Social Catchment 1A (cont'd)

Threat	Impact	Language Group	Phase	Likelihood/ consequence	Risk rating
SV2 - Opportunities for participation in the cash economy (cont'd)					
Availability of business opportunities due to higher levels of disposable income resulting from the Project leads to in-migration and increased competition	Reduced availability of business opportunities for local communities	Miyan, Telefol	C, O	Possible / moderate	Medium
		Paiyamo		Likely / moderate	Medium
In-migration of people with higher levels of education and work experience	Reduced opportunity to gain formal employment	Miyan, Telefol	C, O	Possible / moderate	Medium
		Paiyamo		Almost certain / minor	Medium
Project procurement and increase in cash incomes increases the demand for local food, goods and services	Increased cost of local food, goods and services	Miyan, Telefol	C, O	Likely / minor	Medium
		Paiyamo		Almost certain / minor	Medium
SV3 - Enduring ability to sustain cultural identity and traditions					
Construction earthworks disrupt or destruct items or sites of cultural significance	Erosion of cultural understandings and sense of place	All	C, O	Almost certain / minor	Medium
Reduced access to traditional lands	Erosion of cultural understandings, sense of place and traditional leadership, including from changes in economic status	Miyan, Telefol	C	Almost certain / minor	Medium
Improved access and communications infrastructure erodes traditional cultural practices with greater exposure to alternate ideas and practices	Loss of traditional lifestyles and practices	All	C, O	Possible / moderate	Medium
Improved access	Damage or destruction to cultural heritage sites	All	C, O	Unlikely / moderate	Medium
Availability of regular high levels of income and formal employment from Project	Erosion of traditional cultural practice	All	C, O, PC	Likely / minor	Medium
Long term involvement with and dependency on the Project erodes traditional cultural practices	Loss of traditional lifestyles and practices	All	C, O, PC	Likely / moderate	Medium
Project workforce inadvertently or maliciously damaging or destroying items or areas with cultural heritage values	Damage or destruction to cultural heritage	All	C, O, PC	Unlikely / moderate	Medium

Table 9.9 Residual Risks for Social Catchment 1A (cont'd)

Threat	Impact	Language Group	Phase	Likelihood/ consequence	Risk rating
SV3 - Enduring ability to sustain cultural identity and traditions (cont'd)					
In-migration creating pressure on land and resources	Reduced ability to maintain customary rights and practices	Miyan, Telefol	C, O, PC	Possible / moderate	Medium
		Paiyamo		Likely / moderate	Medium
In-migration resulting in the clearing of areas for new settlements	Damage or destruction to cultural heritage	Paiyamo	C, O, PC	Unlikely / moderate	Medium
Project income results in a transition to a cash-based economy and directly changes traditional behaviour and practices	Accelerated change to cultural identity and traditions	All	C, O	Likely / moderate	Medium
SV4 - An enduring ability to maintain customary rights to land access and resource use					
Changes to existing land uses and major alterations of the appearance of the landscape cause a sense of loss	Impaired health and well-being	All	C, O, PC	Possible / moderate	Medium
Loss of access to and use of lands	Land within the SML will not be accessible and there may be restrictions around land use in accordance with customary rights. Land within the FRHEP will be lost permanently.	All	C, O, PC	Almost certain / moderate	High
Modification of landscape	FRHEP inundation or pit excavation may lead to ambiguity around land boundaries as previous boundary features and markers no longer exist	All	C, O, PC	Almost certain / minor	Medium
Access to customary lands impacted by road corridor	The main access road corridor runs through customary lands; access to lands and resource use may become an issue should in-migration occur or external service industries seek to establish themselves in the area	All	O	Likely / minor	Medium
Change in traditional leadership as non-traditional forms of knowledge and skill related to Project employment become more central to social life	Reduced ability to mediate land access and resource use issues	All	C, O, PC	Likely / moderate	Medium

Table 9.9 Residual Risks for Social Catchment 1A (cont'd)

Threat	Impact	Language Group	Phase	Likelihood/ consequence	Risk rating
SV4 - An enduring ability to maintain customary rights to land access and resource use (cont'd)					
People migrating to the Project area asserting rights to land and residency so as to claim a share of royalties and compensation	Disputes over customary rights and access to lands	Miyan, Telefol	C, O, PC	Possible / moderate	Medium
		Paiyamo		Likely / moderate	Medium
SV5 - An environment amenable to personal and family health, education, safety and security					
Improved access to and greater interaction with townships and markets due to completion of the road increases the availability of alcohol and drugs	Decrease in security for women and children and increase in inter-personal violence	All	C, O, PC	Possible / moderate	Medium
Improved access to and greater interaction with townships and markets due to completion of the road leads to increased interpersonal interaction	Higher exposure to infectious diseases	All	C, O, PC	Possible / moderate	Medium
Accident associated with Project vessel or vehicular movements	Fatality, injury and / or trauma	All	C, O	Unlikely / critical	High
Local workers in accommodation camps exposed to higher levels of morbidity due to an increase in disease exposure and changes to diets	Increase in the prevalence of disease and health problems	All	C, O	Possible / moderate	Medium
A decrease in gardening, hunting or fishing effort due to more time spent in Project employment results in an increased reliance on store bought food	Changes to community nutritional status	All	C, O	Unlikely / moderate	Medium
Change in the distribution of labour within the household where parents of children are employed by Project and children are required to take on additional household duties	Decreased attendance at school	All	C, O	Unlikely / moderate	Medium
Presence of the Project workforce leading to the increased availability of alcohol and drugs in communities	Decrease in security for women and children and increase in inter-personal violence	All	C, O	Possible / moderate	Medium
Local people employed by the Project exposed to diseases as a result of mixing with the broader workforce and subsequently introducing these into the village	Higher incidence of sexually transmitted and infectious diseases	All	C, O	Possible / moderate	Medium

Table 9.9 Residual Risks for Social Catchment 1A (cont'd)

Threat	Impact	Language Group	Phase	Likelihood/ consequence	Risk rating
SV5 - An environment amenable to personal and family health, education, safety and security (cont'd)					
Project security workers misusing power and using excessive force when dealing with members of the public	Human rights abuse by members by Project security personnel	All	C, O	Unlikely / moderate	Medium
State police force using excessive force when dealing with members of the public	Human rights abuse by members by State security personnel	All	C, O	Unlikely / moderate	Medium
Air emissions (e.g. dust, vehicle emissions), water discharges noise, vibration and light generated from movement of Project vehicles, machinery and vessels.	Impaired community amenity and health concerns	All	C, O	Possible / moderate	Medium
Community concern about Project effects on beneficial environmental values of waterways leads to heightened levels of anxiety	Impaired health and well-being	All	C, O, PC	Possible / moderate	Medium
Inappropriate transport, storage and handling of hazardous materials leads to loss of containment	Increased human health risk due to exposure to spills of hazardous materials	All	C, O	Possible / moderate	Medium
Community concern about Project effects on beneficial environmental values of waterways leads to heightened levels of anxiety	Impaired health and well-being	Paiyamo	C, O, PC	Possible / moderate	Medium
In-migration effects on access to land and resources resulting in tensions in social relations	Disruption to social relations and community wellbeing	All	C, O	Likely / moderate	Medium
Population growth due to in-migration resulting in increased violations of law and order and a reduced level of safety	Deterioration of community safety and security	All	C, O	Possible / moderate	Medium
The distribution of Project benefits leading to disputes amongst landowners	Reduced safety and security of communities	All	C, O	Likely / minor	Medium
Disparities in income due to non-uniform participation in Project opportunities and differential access to Project benefits	Increased inequality within communities	All	C, O	Likely / minor	Medium
Higher income levels resulting in less emphasis given to formal education	Reduction in school attendance	All	C, O	Likely / moderate	Medium

Table 9.9 Residual Risks for Social Catchment 1A (cont'd)

Threat	Impact	Language Group	Phase	Likelihood/consequence	Risk rating
SV5 - An environment amenable to personal and family health, education, safety and security (cont'd)					
Changes in lifestyle and behaviour, particularly for young adult males removed from social restraints with high levels of disposable income, leading to sexual behaviour which increases risk of infection	Increase in the incidence of sexually transmitted diseases	All	C, O	Possible / moderate	Medium
Weakened traditional authority, combined with high levels of disposable income and the presence of outsiders increasing the general availability of alcohol and drugs in communities	Decrease in security for women and children and increase in inter-personal violence, prostitution, bride prices etc.	All	C, O	Possible / moderate	Medium
SV6 - The availability of services supportive of personal health, education, safety and security					
In migration increasing the demand for health, emergency and education services	Reduced availability of health, emergency and education services for local residents	All	C, O	Unlikely / moderate	Medium

Note: C – construction; O – operation; PC – post-closure

9.5.2 Social Catchment 1B: New infrastructure and road corridor, Hotmin to Green River

Social Catchment 1B encompasses part of the proposed public road corridor extending from Hotmin to Green River, approximately 90 km (Section 7.3.5). Subsistence practices play a significant role in the livelihoods of households within the catchment. There is currently sufficient access to resources to provide for a subsistence lifestyle throughout the catchment with a variety of produce grown and animals hunted. Opportunities for formal employment and participation in the cash economy are limited, however Hotmin, and to a lesser extent Temsapin and Uramesin 2, have access to local markets for the sale of surplus subsistence production.

Culture in the catchment has been undergoing a process of slow change since initial contact by the Australian colonial administration (Gardner, 1996b). However, culture is very much underpinned by traditional rights to land access and resource use and there has been no large-scale land alienation for uses such as cash cropping or logging, or use of waterways for commercial purposes.

The communities within Catchment 1B generally experience a safe and secure social environment, largely due to the remoteness of the villages. The current physical and social environment ensures family safety and security, however it is an obstacle when accessing health facilities. Communities in general do not receive regular services supportive of personal health, safety and security due to the limited public infrastructure.

A summary of the potential impacts to social values in Social Catchment 1B is provided below.

Livelihoods - The capacity to support subsistence livelihoods (Social Value 1) and the opportunity to participate in the cash economy (Social Value 2)

There will be a continuing dependence on subsistence livelihoods in the social catchment until cash incomes improve significantly. Securing work in Project construction may limit labour participation in subsistence production, though this is likely to be in place for a limited period due to the relatively short-term nature of construction activity. Improved access may also support labour migration to urban centres such as Vanimo as it may make more frequent return journeys feasible.

In general, full access to subsistence resources will be maintained along the road corridor as the alienated land will be a very small percentage of that available. There may be minor environmental impairment due to construction impacts (e.g., temporarily elevated sediment loads in streams) and the potential for modified hydrology where the road corridor traverses back swamp areas. These impacts are predictable and there are standard construction design and environmental management measures that will be employed.

Improved access to the catchment via the public road may stimulate further logging or industrial-scale agriculture, such as oil palm plantations, which will remove land from subsistence production while generating some employment. Logging operations are already occurring on the south side of the Sepik River and the Idam-Siawi Integrated Agroforestry Development Project is under development (a proposed extensive Forest Management Area to the west of the road alignment, between Idam, Green River and the Indonesian border). Should these projects proceed, effective impact management will require collaboration between parties to the developments and effective regulation by government agencies. The cumulative socio-economic impacts of the Project and the Idam-Siawi Integrated Agroforestry Development Project are further described in Chapter 10.

While there will be potential for in-migration along the road corridor, effects are more likely to be felt in areas closer to population centres, such as at Green River or Hotmin. This may create opportunities for the sale of surplus subsistence crops in these locations. Public road access to larger population centres may also provide an opportunity for the planting of cash crops or the commercial exploitation of fish or other aquatic products. The level of alluvial gold production may also increase if the road supports easier access to inputs such as fuel and rations for labour.

Culture - An enduring ability to sustain cultural identity and traditions (Social Value 3) and maintain customary rights to land access and resource use (Social Value 4)

Development of the public road will provide improved connection to population centres that may stimulate population movement and interactions with different cultural groups. Eventually this may lead to longer-term relationships (including marriage) that will act to alter cultural identity. While this may be considered an impact, it is also an outcome of national development that is likely to continue. The presence of the Project in Sandaun Province may act to accelerate this form of change that has been limited to date due to remoteness and lack of access infrastructure. While these changes are likely, the consequences are expected to be moderate resulting in a risk of **medium** significance. Communities in the catchment will also have access to support from the Project for community development initiatives, some of which may aim to celebrate cultural identity and traditions.

In-migration along the road corridor may result in some land appropriation in selected areas, principally near population centres or known alluvial gold areas, which may act to erode customary rights in those areas. The consequences of this action may be moderate and confined

to those areas. The PIIMMS will have measures to limit in-migration and manage consequences, including supporting the development of regional service centres and supporting the capacity of local level governments to establish by-laws to regulate the use of customary land. This could be expected to result in a residual significance of **medium**.

With improved access, there could be increased pressure for the acquisition of land for plantation production, such as the Idam-Siawi Integrated Agro-forestry Development Project, which may restrict access to land if it has been alienated through lease arrangement. The consequences would at least be moderate but would depend on the purpose for which the land was sought. Observations of the fate of other logged land in the province may influence landowners to lean toward protection of their land, however if the need for cash was not satisfied the incentive to lease may be dominant. The securing of Project employment by landowners along the road corridor may act to mitigate the pressure to lease, however the residual significance remains **medium**.

***Personal and community well-being - An amenable environment (Social Value 5)
and the availability of services supportive of personal health, education,
safety and security (Social Value 6)***

Development enabled by improved road access and reticulated power (employment, production for sale, cash crop production) is expected to lead to improved household income levels, a portion of which may be allocated to the improvement of housing, such as corrugated iron roofing and water tanks. Improved access and power may also facilitate the establishment of commercial trade stores and more reliable access to government services because of lower service costs.

There may be some loss of amenity experienced by villages near the road during construction and operations due to dust and noise, though this is expected to be moderate. Safety risks resulting from the interaction of residents and traffic are certain as villagers will use the road as a pedestrian walkway, with the potential for loss of life in a serious vehicle-pedestrian incident, resulting in a risk significance of **high**. This risk is capable of being managed through implementation of traffic management and safety plans, drawing on the experience of other major infrastructure and resource projects in PNG, however even with effective plan implementation the residual significance remains **high** due to the potential for fatalities.

The presence of a construction workforce for the infrastructure corridor may lead to potential health and security risks which, in the absence of effective management, would be of **medium** significance. There are a range of management measures which will be included in a construction social management plan including careful camp location, sufficiently distant from a village to minimise impact but not exclude village employment, and camp and employment codes of practice to manage employee behaviour. These reduce the likelihood to possible with a resulting **medium** level of significance. Depending on camp location, there may also be opportunities for local food supply to camps, though this would be short-term in duration and of limited scale due to the rate of construction and the regular relocation of work camps along the infrastructure corridor.

Improved access may also support the more effective provision and maintenance of public infrastructure as well as improve the attendance and retention of service provider staff such as teachers, aid post orderlies and police officers.

Table 9.10 presents the residual risks with medium or higher significance ratings for Social Catchment 1B.

Table 9.10 Residual Risks for Social Catchment 1B

Threat	Impact	Phase	Likelihood/ consequence	Risk rating
SV1 - The capacity to support subsistence livelihoods				
Construction earthworks interferes with existing water supplies	Pollution of water affects drinking water and food sources such as gardens or aquatic resources	C	Possible / moderate	Medium
Earthworks associated with road construction and extraction of construction water compromise clean water supplies	Health impairment through drinking contaminated water	C	Possible / moderate	Medium
Absence of male labour for farming or gardening activities due to Project employment	Reduction in the availability of food from gardens	C, O, PC	Unlikely / moderate	Medium
Absence of female labour for farming or gardening activities due to Project employment	Reduction in the availability of food from gardens	C, O, PC	Unlikely / moderate	Medium
Project accidental spills or leaks pollute land and / or water resources	Food sources are affected by pollution of land and / or water resources	C, O	Possible / moderate	Medium
Population growth due to in-migration placing pressure on land used to support gardens which reduces garden productivity	Reduced ability to lead subsistence livelihoods	C, O	Likely / moderate	High
Population growth due to in-migration resulting in greater demand and subsequent scarcity of terrestrial and aquatic resources	Reduced ability to support subsistence livelihoods	C, O	Likely / moderate	High
In-migration and an increase in earning capacity puts pressure on land and resources and results in increased cost of store bought and market food	Reduced opportunity for people to purchase food, and insufficient dietary intake, which leads to an increased reliance on subsistence lifestyles	C, O	Likely / moderate	Medium
The ongoing regular availability of increased levels of cash allowing people to purchase items such as guns and traps which will enhance the effectiveness of hunting practices and lead to overharvesting	Reduction in the availability of terrestrial fauna for subsistence purposes	C, O	Almost certain / minor	Medium
SV2 - Opportunities for participation in the cash economy				
Increased access provided by road construction leads to increased business competition	Reduced opportunity for business activity and income not realised due to increased business competition	C, O, PC	Likely / minor	Medium

Table 9.10 Residual Risks for Social Catchment 1B (cont'd)

Threat	Impact	Phase	Likelihood/ consequence	Risk rating
SV2 - Opportunities for participation in the cash economy (cont'd)				
Reduction in local employment opportunities when Project transitions from construction to operation, and when FRCGP transitions from operation to closure	Loss employment leads to social unrest	C, O, PC	Likely / moderate	Medium
Availability of business opportunities due to higher levels of disposable income resulting from the Project leads to in-migration and increased competition	Reduced availability of business opportunities for local communities	C, O	Likely / moderate	Medium
In-migration of people with higher levels of education and work experience	Reduced opportunity to gain formal employment	C, O	Almost certain / minor	Medium
Project procurement and increase in cash incomes increases the demand for local food, goods and services	Increased cost of local food, goods and services	C, O	Likely / minor	Medium
SV3 - Enduring ability to sustain cultural identity and traditions				
Construction earthworks disrupt or destruct items or sites of cultural significance	Erosion of cultural understandings and sense of place	C, O	Unlikely / moderate	Medium
Improved access and communications infrastructure erodes traditional cultural practices with greater exposure to alternate ideas and practices	Loss of traditional lifestyles and practices	C, O	Possible / moderate	Medium
Improved access	Damage or destruction to cultural heritage sites	C, O	Unlikely / moderate	Medium
Availability of regular high levels of income and formal employment from Project	Erosion of traditional cultural practice	C, O, PC	Likely / minor	Medium
Long term involvement with and dependency on the Project erodes traditional cultural practices	Loss of traditional lifestyles and practices	C, O, PC	Possible / moderate	Medium
Project workforce inadvertently or maliciously damaging or destroying items or areas with cultural heritage values	Damage or destruction to cultural heritage	C, O, PC	Unlikely / moderate	Medium
In-migration creating pressure on land and resources	Reduced ability to maintain customary rights and practices	C, O, PC	Likely / moderate	Medium
In-migration resulting in the clearing of areas for new settlements	Damage or destruction to cultural heritage		Unlikely / moderate	Medium

Table 9.10 Residual Risks for Social Catchment 1B (cont'd)

Threat	Impact	Phase	Likelihood/ consequence	Risk rating
SV3 - Enduring ability to sustain cultural identity and traditions (cont'd)				
Project income results in a transition to a cash-based economy and directly changes traditional behaviour and practices	Accelerated change to cultural identity and traditions	C, O	Likely / moderate	Medium
SV4 – An enduring ability to maintain customary rights to land access and resource use				
<i>Access and communications infrastructure</i>				
Access to customary lands impacted by road corridor	The main access road corridor runs through customary lands; access to lands and resource use may become an issue should in-migration occur or external service industries seek to establish themselves in the area	O	Likely / Minor	Medium
Change in traditional leadership as non-traditional forms of knowledge and skill related to Project employment become more central to social life	Reduced ability to mediate land access and resource use issues	C, O, PC	Likely / moderate	Medium
People migrating to the Project area asserting rights to land and residency so as to claim a share of royalties and compensation	Disputes over customary rights and access to lands	C, O, PC	Likely / moderate	Medium
SV5 - An environment amenable to personal and family health, education, safety and security				
Air emissions (e.g. dust, vehicle emissions), noise, vibration and / or light generated from the construction and operation of the road and Vanimo Ocean Port	Impaired community amenity and health concerns	C, O	Possible / moderate	Medium
Improved access to and greater interaction with townships and markets due to completion of the road increases the availability of alcohol and drugs	Decrease in security for women and children and increase in inter-personal violence	C, O, PC	Possible / moderate	Medium
Improved access to and greater interaction with townships and markets due to completion of the road leads to increased interpersonal interaction	Higher exposure to infectious diseases	C, O, PC	Possible / moderate	Medium
Accident associated with Project vessel or vehicular movements	Fatality, injury and / or trauma	C, O	Unlikely / critical	High
Local workers in accommodation camps exposed to higher levels of morbidity due to an increase in disease exposure and changes to diets	Increase in the prevalence of disease and health problems	C, O	Likely / moderate	Medium

Table 9.10 Residual Risks for Social Catchment 1B (cont'd)

Threat	Impact	Phase	Likelihood/ consequence	Risk rating
SV5 - An environment amenable to personal and family health, education, safety and security (cont'd)				
A decrease in gardening, hunting or fishing effort due to more time spent in Project employment results in an increased reliance on store bought food	Changes to community nutritional status	C, O	Unlikely / moderate	Medium
Change in the distribution of labour within the household where parents of children are employed by Project and children are required to take on additional household duties	Decreased attendance at school	C, O	Unlikely / moderate	Medium
Presence of the Project workforce leading to the increased availability of alcohol and drugs in communities	Decrease in security for women and children and increase in inter-personal violence	C, O	Possible / moderate	Medium
Local people employed by the Project exposed to diseases as a result of mixing with the broader workforce and subsequently introducing these into the village	Higher incidence of sexually transmitted and infectious diseases	C, O	Possible / moderate	Medium
Project security workers misusing power and using excessive force when dealing with members of the public	Human rights abuse by members by Project security personnel	C, O	Unlikely / moderate	Medium
State police force using excessive force when dealing with members of the public	Human rights abuse by members by State security personnel	C, O	Unlikely / moderate	Medium
Air emissions (e.g. dust, vehicle emissions), water discharges noise, vibration and light generated from movement of Project vehicles, machinery and vessels.	Impaired community amenity and health concerns	C, O	Possible / moderate	Medium
Inappropriate transport, storage and handling of hazardous materials leads to loss of containment	Increased human health risk due to exposure to spills of hazardous materials	C, O	Possible / moderate	Medium
In-migration effects on access to land and resources resulting in tensions in social relations	Disruption to social relations and community wellbeing	C, O	Likely / moderate	Medium
Population growth due to in-migration resulting in increased violations of law and order and a reduced level of safety	Deterioration of community safety and security	C, O	Possible / moderate	Medium
The distribution of Project benefits leading to disputes amongst landowners	Reduced safety and security of communities	C, O	Likely / minor	Medium
Disparities in income due to non-uniform participation in Project opportunities and differential access to Project benefits	Increased inequality within communities	C, O	Likely / minor	Medium

Table 9.10 Residual Risks for Social Catchment 1B (cont'd)

Threat	Impact	Phase	Likelihood/ consequence	Risk rating
SV5 - An environment amenable to personal and family health, education, safety and security (cont'd)				
Higher income levels resulting in less emphasis given to formal education	Reduction in school attendance	C, O	Likely / moderate	Medium
Changes in lifestyle and behaviour, particularly for young adult males removed from social restraints with high levels of disposable income, leading to sexual behaviour which increases risk of infection	Increase in the incidence of sexually transmitted diseases	C, O	Possible / moderate	Medium
Weakened traditional authority, combined with high levels of disposable income and the presence of outsiders increasing the general availability of alcohol and drugs in communities	Decrease in security for women and children and increase in inter-personal violence, prostitution, bride prices etc.	C, O	Possible / moderate	Medium
SV6 - The availability of services supportive of personal health, education, safety and security				
In migration increasing the demand for health, emergency and education services	Reduced availability of health, emergency and education services for local residents	C, O	Unlikely / moderate	Medium

Note: C – construction; O – operation; PC – post-closure

9.5.3 Social Catchment 1C: Existing infrastructure corridor, Green River to Vanimo

The infrastructure and road corridor social catchment consists of Green River and villages located in proximity to the existing public road between Vanimo and Green River, including Aminii, Kwomtari, Itomi, Kilifas, Sumunini and Imbrinis (Section 7.3.5). Land use in the northern portion of the catchment is currently dominated by logging and oil palm plantations which use the existing road. Villages in the south of the catchment are largely isolated and are located along the existing road corridor at intervals of approximately 10 to 20 km.

Opportunities to support a subsistence lifestyle are strong given favourable seasonal conditions, however some areas are vulnerable to unfavourable environmental conditions such as flooding and pressure from the impacts of logging and oil palm operations. Proximity to Vanimo and employment with logging and oil palm operations provide greater opportunities for participation in the cash economy than within Catchment 1B, however opportunities are still limited. Increased exposure to the cash economy in some circumstances has seen a rise in substance abuse and law and order issues. There is limited public infrastructure and access to services supportive of personal health, safety and security.

The infrastructure corridor will be subject to more frequent vehicle movements during construction and operation of the FRCGP and FRHEP. Construction activity will likely include: in-river work such as the driving of piles and construction of bridge abutments; clearing of vegetation in the corridor and pipe laydown areas; quarrying and transport of road making material; road construction including the placement, shaping and compaction of pavement material; pipeline trench excavation, pipe transport, welding, testing, lowering and trench backfilling. There will be a

number of construction camps (estimated at up to 200 person capacity) established to support this activity and the existing airstrip at Green River will be upgraded to an international standard.

The following summary sets out the key Project-induced causes of social change and the associated impacts on social values within Social Catchment 1C.

Livelihoods - The capacity to support subsistence livelihoods (Social Value 1) and the opportunity to participate in the cash economy (Social Value 2)

The viability of subsistence livelihoods in the catchment has already been adversely affected by the impacts of logging and oil palm plantation establishment. While the construction of the road, pipeline and transmission line may impose some impairment to the existing environment (e.g., water course impacts and land clearing for quarries), this is expected to be relatively limited and short-term having a **low** significance, and amenable to control using standard construction environmental management techniques.

It is possible that the improved access provided by the road upgrade may enhance the viability of existing broad scale land use (oil palm) and former land uses (such as rubber plantations near Green River) leading to the conversion of more land to cash cropping. In-migration may also increase population density in key areas, such as Green River, and the availability of employment through commercial development may further draw some residents away from subsistence production towards dependence on store-bought foods. The upgraded road should result in lower vehicle operating costs and a higher level of reliability than the existing road to Green River. In turn, this should promote the entrance of more transport service providers with competition leading to lower costs for local users. This should facilitate an expansion in the marketing of subsistence surplus in both Green River and Vanimo (and possibly the mine area) as a viable income-generating activity. The ease of access to Vanimo and the mine area should also support job opportunities for residents of the corridor.

While improved access should enable more economic activity in the catchment, limited access to investment funds by locals may still inhibit local-led development creating opportunities for external investment, particularly in trading ventures that repatriate profits out of the local area.

Culture - An enduring ability to sustain cultural identity and traditions (Social Value 3) and maintain customary rights to land access and resource use (Social Value 4)

The population within the catchment has been subject to significant lifestyle change over the past decades including change due to the presence of large-scale logging operations with follow-up planting of oil palm plantations. This has exposed the population to outside cultural influences to a significantly greater extent than what has occurred in Social Catchment 1B.

While it is possible for disturbance of cultural heritage through the establishment of quarries to source road construction material (with moderate consequence and a medium level of significance), the implementation of a cultural heritage management plan requiring pre-clearance surveys should make disturbance unlikely, however with a significance level unchanged at **medium** as the consequences of disturbance will still be moderate. The potential for disturbance to cultural heritage sites is lower when compared to Social Catchment 1B as the road will largely be upgraded along the existing alignment.

Improved access will stimulate in-migration, particularly to the Green River area. This in-migration is envisaged and supported by the government as Green River is designated a Level 2 Growth Centre under the Sandaun Province Growth Centre Strategy (Vanimo being Level 1). This could lead to additional land requirements at the station, however this would be subject to negotiation

with customary owners who are generally supportive of development in the area to restore and upgrade infrastructure and to provide commercial business opportunities. While it is possible that this development could impair customary rights to land, the residual level of significance is **low**.

Personal and community well-being - An amenable environment (Social Value 5) and the availability of services supportive of personal health, education, safety and security (Social Value 6)

Amenity in villages in proximity to the upgraded road has the potential to be degraded through increased traffic-generated noise and dust, as well as elevating the risk to pedestrians using the road as a walkway. The likelihood of accident trauma is possible and the consequences are critical as there is the potential for life-threatening injuries resulting in a **high** significance. However, there are well-proven measures to reduce the risk likelihood including the incorporation of safety features in road and bridge design, such as routing the alignment around rather than through villages, installing pedestrian walkways separated from the road carriageway, and pavement sealing where the road goes through a village to reduce the possibility of dust nuisance, and incorporating traffic management measures for Project vehicles such as restricting travel at night and limiting vehicle speeds, which will be monitored through the use of GPS tracking. Accident trauma following the application of management measures will be unlikely, with the consequence remaining at critical due to the possibility of serious injury, resulting in a residual significance of **high**.

In general, upgraded road access should support improved levels of service delivery for government-provided services in health, education and policing, though in-migration to Green River may require the expansion of these services and their enabling infrastructure to cope with a higher level of demand. The Project will work with the Sandaun Provincial Government to assess needs and consider the need for support through the community development program.

As with Catchment 1B, the presence of a construction workforce may lead to potential health and security risks which, in the absence of effective management, would be of **medium** significance. Similar management measures to Catchment 1B would be included in a construction social management plan including careful camp location and camp and employment codes of practice to manage employee behaviour. These can lower the likelihood to possible with a resulting **medium** level of residual significance. Depending on camp location, there may also be opportunities for local food supply to camps, though this would be short-term and of limited scale due to the rate of construction and the regular relocation of work camps along the road corridor.

Table 9.11 presents the residual risks with medium or higher significance ratings for Social Catchment 1C.

Table 9.11 Residual Risks for Social Catchment 1C

Threat	Impact	Phase	Likelihood/ consequence	Risk rating
SV1 - The capacity to support subsistence livelihoods				
Construction earthworks interferes with existing water supplies	Pollution of water affects drinking water and food sources such as gardens or aquatic resources	C	Possible / moderate	Medium

Table 9.11 Residual Risks for Social Catchment 1C (cont'd)

Threat	Impact	Phase	Likelihood/ consequence	Risk rating
SV1 - The capacity to support subsistence livelihoods (cont'd)				
Earthworks associated with road construction and extraction of construction water compromise clean water supplies	Health impairment through drinking contaminated water	C	Possible / moderate	Medium
Project accidental spills or leaks pollute land and / or water resources	Food sources are affected by pollution of land and / or water resources	C, O	Possible / moderate	Medium
SV4 – An enduring ability to maintain customary rights to land access and resource use				
Access to customary lands impacted by road corridor	The main access road corridor runs through customary lands; access to lands and resource use may become an issue should in-migration occur or external service industries seek to establish themselves in the area	O	Likely / Minor	Medium
SV5 - An environment amenable to personal and family health, education, safety and security				
Air emissions (e.g. dust, vehicle emissions), noise, vibration and / or light generated from the construction and operation of the road and Vanimo Ocean Port	Impaired community amenity and health concerns	C, O	Possible / moderate	Medium
Improved access to and greater interaction with townships and markets due to completion of the road increases the availability of alcohol and drugs	Decrease in security for women and children and increase in inter-personal violence	C, O, PC	Possible / moderate	Medium
Improved access to and greater interaction with townships and markets due to completion of the road leads to increased interpersonal interaction	Higher exposure to infectious diseases	C, O, PC	Possible / moderate	Medium
Accident associated with Project vessel or vehicular movements	Fatality, injury and / or trauma	C, O	Unlikely / critical	High
Presence of the Project workforce leading to the increased availability of alcohol and drugs in communities	Decrease in security for women and children and increase in inter-personal violence	C, O	Unlikely / moderate	Medium
Project security workers misusing power and using excessive force when dealing with members of the public	Human rights abuse by members by Project security personnel	C, O	Unlikely / moderate	Medium

Table 9.11 Residual Risks for Social Catchment 1C (cont'd)

Threat	Impact	Phase	Likelihood/ consequence	Risk rating
SV5 - An environment amenable to personal and family health, education, safety and security (cont'd)				
State police force using excessive force when dealing with members of the public	Human rights abuse by members by State security personnel	C, O	Unlikely / moderate	Medium
Inappropriate transport, storage and handling of hazardous materials leads to loss of containment	Increased human health risk due to exposure to spills of hazardous materials	C, O	Possible / moderate	Medium

Note: C – construction; O – operation; PC – post-closure

9.5.4 Social Catchment 1D: Vanimo Ocean Port

The Vanimo Ocean Port catchment includes Vanimo and the adjacent settlements of Wesdeco and Cis Point (Section 7.3.6). The Port of Vanimo is currently used for commercial activities, primarily round log and sawn timber export. The port will be upgraded as part of the SIP to include two new berths and associated facilities to support the FRCGP and other port users. The treated filtrate from the concentrate filter plant will be released to Dakriro Bay and there will potentially be emissions from the FRCGP facilities including diesel power plant exhaust during construction, dust and noise.

Livelihoods for residents of Cis Point and Wesdeco are primarily based on paid employment in the Vanimo area with fishing, reef gleaning and minor agriculture (kitchen gardens) being subsidiary activities that support viable livelihoods. While Vanimo is primarily a government and private sector service centre with a reasonably well-developed store precinct and cross border trade with Jayapura in Indonesian Papua, tourism based on surfing, and the associated provision of accommodation for this purpose at Lido, is a niche industry activity for which Vanimo is becoming increasingly well-known. Vanimo also hosts a timber processing sector and is the base for a detachment of the PNG Defence Force responsible for border patrolling.

Commercial fishing in the Vanimo area is limited due to natural constraints such as the lack of reef areas and adverse sea conditions. Fish for sale in the small harbour side market are generally caught in areas further east, closer to Aitape. Pressure on customary land has increased over the years with in-migration and development. The potential for growth in Vanimo is moderate and will be strengthened with the development of the Vanimo Ocean Port to support the FRCGP, the provision of power through the SPGP that may stimulate industrial growth in the Vanimo-Jayapura border corridor and infrastructure improvements such as the Asian Development Bank-financed airport runway extension to support higher passenger capacity jet aircraft operations.

A summary of the potential impacts to social values in Social Catchment 1D is provided below.

Livelihoods - The capacity to support subsistence livelihoods (Social Value 1) and the opportunity to participate in the cash economy (Social Value 2)

Impacts on resource use from the construction and operations of the Vanimo Ocean Port will largely be confined to the area immediately surrounding the port development site which is contained within the existing port boundary (see Chapter 5, Figure 5.8). There will be some alteration of the nearshore marine environment arising from a small area required for reclamation, as well as noise impacts from construction due to pile driving and new berth construction activity. It is noted that there is minimal resource use from this area. Construction will also impair the

amenity of the town area through increased vehicular traffic and the installation of the concentrate pipeline. These impacts will be managed through a construction environmental management plan which includes a traffic management plan. However, the residual risk significance will remain at **medium**. During operations excess filtrate water from the concentrate thickener will be reused for washdown with the excess being mechanically treated to remove solids prior to discharge to the marine environment. Hydrodynamic modelling indicates that PNG ambient marine water quality guidelines will be met (under conservative conditions) at about 10 m from the discharge location.

Construction of the port facilities will present opportunities for employment and skill development for Vanimo residents and landowners of the port area. There will also be a limited number of employment opportunities during port operations. However, there is expected to be a higher level of commercial activity supporting the FRCGP, and other industry sectors that may expand with access to improved infrastructure, with concomitant increase in employment levels above those currently available. In-migration to Vanimo is highly likely and is expected to be generally positive in its effects which will focus on commercial opportunities for the provision of goods and services. This in-migration is envisaged and supported by the government as Vanimo is designated a Level 1 Growth Centre under the Sandaun Province Growth Centre Strategy.

Culture - An enduring ability to sustain cultural identity and traditions (Social Value 3) and maintain customary rights to land access and resource use (Social Value 4)

Vanimo has developed as a culturally-mixed urban centre over many years. While there is still recognition of the original customary owners, the social fabric of the town is firmly characterised as modern, culturally-diverse Papua New Guinean, with an observable Indonesian influence. The development of a 50-year town plan provides a degree of certainty for customary owners to deal with town expansion land requirements and to manage the potential for in-migrants to occupy land without authorisation. Furthermore, the Port of Vanimo is located with an area zoned as a future international port. Close consultation with customary owners of land near the proposed Vanimo Ocean Port area about port development plans, and potential opportunities for benefit, will be undertaken to avoid misunderstandings and consequent grievances.

Personal and community well-being - An amenable environment (Social Value 5) and the availability of services supportive of personal health, education, safety and security (Social Value 6)

As indicated earlier, the construction of the Vanimo Ocean Port and operation of the concentrate export facility has a likely potential to impair the amenity of adjacent settlements (Wesdeco and Cis Point) through the imposition of noise, light and vehicular traffic at nuisance levels, fugitive dust and altering the character of the existing surrounding environment and visual outlook from one of peri-urban village to one of industrial precinct (see Chapter 8, Plate 8.2). The consequences of this change would be moderate with a residual significance of **medium**. Mitigation measures will need to receive careful consideration at the design phase (sound attenuation at the source, low-impact lighting, dust filters on concentrate storage shed exhausts, etc.), and include close consultation at that stage with the communities so that what is possible (and what is not), and what the outcomes are likely to be, is well-understood. The outcome of the successful implementation of mitigation measures may reduce the consequences to minor with the resultant residual significance remaining at **medium**.

Table 9.12 presents the residual risks with medium or higher significance ratings for Social Catchment 1D.

Table 9.12 Residual Risks for Social Catchment 1D

Threat	Impact	Phase	Likelihood/ consequence	Risk rating
SV1 - The capacity to support subsistence livelihoods				
Project discharge / emissions that exceed guidelines and / or inappropriate waste disposal pollutes land and / or water resources	Food sources are affected by pollution of land and / or water resources	C	Unlikely / moderate	Medium
Project accidental spills or leaks pollute land and / or water resources	Food sources are affected by pollution of land and / or water resources	C, O	Possible / moderate	Medium
SV5 - An environment amenable to personal and family health, education, safety and security				
Air emissions (e.g. dust, vehicle emissions), noise, vibration and / or light generated from the construction and operation of the road and Vanimo Ocean Port	Impaired community amenity and health concerns	C, O	Likely / minor	Medium
Accident associated with Project vessel or vehicular movements	Fatality, injury and / or trauma	C, O	Unlikely / critical	High
Project security workers misusing power and using excessive force when dealing with members of the public	Human rights abuse by members by Project security personnel	C, O	Unlikely / moderate	Medium
State police force using excessive force when dealing with members of the public	Human rights abuse by members by State security personnel	C, O	Unlikely / moderate	Medium
Air emissions (e.g. dust, vehicle emissions), water discharges noise, vibration and light generated from movement of Project vehicles, machinery and vessels.	Impaired community amenity and health concerns	C, O	Likely / moderate	Medium
Community concerns as to the Projects effect on the beneficial environmental and social values of Dakriro Bay	Heightened level of anxiety	C, O, PC	Unlikely / moderate	Medium
Inappropriate transport, storage and handling of hazardous materials leads to loss of containment	Increased human health risk due to exposure to spills of hazardous materials	C, O	Possible / moderate	Medium
Community concerns as to the Project's effect on the beneficial environmental values of Dakriro Bay	Heightened levels of anxiety	C, O, PC	Unlikely / moderate	Medium
Population growth due to in-migration resulting in increased violations of law and order and a reduced level of safety	Deterioration of community safety and security	C, O	Unlikely / moderate	Medium

Note: C – construction; O – operation; PC – post-closure

9.5.5 Social Catchment 2: Sepik River Corridor

The Sepik River corridor social catchment includes villages between the Sepik River bridge crossing and the Sepik River mouth. Prior to the public road being constructed, the Sepik, Frieda and May rivers will be used during construction to barge equipment and materials to the river

ports. This may include transport of large heavy loads to the mine. The public road, once constructed, will be the primary route for the transport of equipment and goods during construction and operations. The Frieda River Port and Sepik and Frieda rivers will also be used during operations to transport freight to the FRCGP and FRHEP in the event that access along the road route is restricted.

The Frieda River Port will be established near the confluence of Owiap Creek and the Frieda River, approximately mid-way between Iniok and Paupe and 10 km east of Auom 3. It will comprise an unloading facility and material laydown area, office facilities and a security facility with associated truck and barge movements.

The key Project-induced causes of social change and the associated impacts on social values within Social Catchment 2 are described in the following sections.

Livelihoods - The capacity to support subsistence livelihoods (Social Value 1) and the opportunity to participate in the cash economy (Social Value 2)

Between the Frieda River Port and the Sepik River mouth, riverside communities will experience barge movements during construction of the FRHEP and FRCGP until the upgrade of the Vanimo to Green River Road is complete. Occasional barge movements may also be experienced during operations in the event that road access is restricted. The residents of the Sepik River corridor are highly dependent on the river for subsistence, income, recreation and cultural activity. Communities along the Sepik River reported fishing on a nearly daily basis and consuming fish almost daily.

Some villages in Catchment 2 may experience some highly localised and short term disruption to fishing associated with barge movements during construction. Fishing activity in the Frieda River has the potential to be disturbed during construction (in advance of the public road being constructed) by barge movements as fish nets may not be able to be set when barges are passing through, or they could be damaged or destroyed by passing barges if not removed beforehand. Barge movements along the Sepik River are unlikely to impact fishing as fishing is predominantly undertaken in off-river water bodies and not in the Sepik River main channel.

There are large numbers of both freshwater and saltwater crocodiles within the Sepik River corridor, particularly from Kubkain to the mouth, and the crocodile industry is important for Sepik River communities. The numbers of wild crocodiles are not expected to be impacted by the Project (refer Chapter 8) and crocodile farming is also not expected to be impacted as breeding activities and harvesting of crocodile eggs, juveniles and adults typically occurs in off-river waterbodies which modelling predicts will not be impacted by the Project (Appendix 5).

There was previously a crocodile farm at Auom 3 which is no longer operating, presumably due to it being financially unviable. Crocodile farms within villages along the Sepik River, if present during construction of the FRHEP and FRCGP, are unlikely to be impacted by barge vessel wash due the slow speed of Project barges and the small wave produced, similar to existing logging barges that traffic the river. Barge movements along the Sepik River will predominantly be for three years during construction and are unlikely to affect crops and sago production along the river banks.

Sepik River corridor villages have expressed a high level of concern for the aquatic environment as they have a close affinity with the health of the river which is vital to their well-being. Communities have expressed concern over the potential for river pollution should the structural integrity of the ISF embankment be compromised, or should there be spillage of chemicals or

fuels which are not contained during construction and operations, and which subsequently enter the river systems.

The Project will implement barge vessel operation management measures to ensure safe handling and transport of equipment and materials during construction. Water monitoring will be conducted at various locations along the barging transport corridor, as outlined in the Project EMMPs, including the regular testing of discharges associated with the Project and implementation of remedial actions if required. As the aquatic ecology of the Sepik River will not be impacted, village reliance on resource use along the river for livelihood purposes will not be diminished.

To monitor impacts on subsistence production from barge movements, fish stocks and local harvest will be monitored at select locations prior to construction, at regular intervals during construction and six months post construction. An operational response will be developed in the event that surveys indicate Project impairment of local harvest outside the predictions of the EIS and determined compensation agreements. The consequence of barge movements impacting livelihood activity along the Sepik River are moderate, as the village of Iniok has a very high level of dependence on aquatic resources (in particular sago and fish) for subsistence. The residual significance is assessed as **low**.

Culture - An enduring ability to sustain cultural identity and traditions (Social Value 3) and maintain customary rights to land access and resource use (Social Value 4)

Project barging activity on the Sepik River will be minimal in the period following construction of the Sepik River bridge and the Hotmin road, and is not expected to impact Social Values 3 and 4 in Social Catchment 2.

Personal and community well-being - An amenable environment (Social Value 5) and the availability of services supportive of personal health, education, safety and security (Social Value 6)

Communities throughout the Sepik River corridor have a close affinity with the health of the Sepik River, which is vital to their well-being. The river is used as a primary water source by many of the villages along its length despite the fact that women surveyed (at Iniok) recognised consumption of water from the Sepik River as being a significant source of sickness and infection in their children.

Construction of the Frieda River Port and barge movements along the Sepik and Frieda rivers have the potential to create a minor disturbance to amenity of households in villages or hamlets located in close proximity to the proposed port and/or along the banks of these rivers, such as at Iniok.

There is a risk that the wash effect of barges travelling along the Sepik River could lead to minor flooding in houses built in proximity to the banks, as during periods of flooding the water level along the river rises close to the underside of the flooring of houses. During such periods the wash caused by Project vessels could result in instances where lower-level houses become inundated. This would reduce the amenity of housing and potentially affect the health and well-being of residents. This issue will be monitored by FRL and preventative actions taken if found to occur.

Use of the Sepik and Frieda rivers for transport of material and hazardous goods such as fuel and chemicals, as well as concerns regarding the structural integrity and safety of the ISF embankment, the potential for increased sediment loads and the introduction of contaminants,

may induce a heightened level of anxiety among residents in the catchment. This anxiety has been expressed during community engagement undertaken to date.

Downstream water quality modelling predicted that water quality in the Sepik River would meet health-based WHO drinking water guidelines (2017) with the exception of total concentrations of lead which are already elevated under existing conditions. The concentrations of dissolved metals and metalloids in water in the Sepik River are also expected to be within the range of background concentrations, with two exceptions. The first exception is aluminium concentrations which are not anticipated to result in acute and chronic toxicity to aquatic ecosystems based on US Environmental Protection Agency calculated site-specific aluminium criteria (US EPA, 2017a and 2017b). The second exception is copper concentrations, of which labile concentrations are indicated to approach the ANZECC/ARMCANZ (2000) guideline for copper for aquatic ecosystems and will be further reduced by adsorption to suspended particulate matter. As such, there are predicted to be no adverse impacts to people from drinking water or consuming fish or other wildlife from waterways in the Sepik River as a result of the Project. Modelling also predicts that Project-related suspended sediment concentrations in the Sepik River will remain comparable to existing conditions. However, perceptions within the population may be different, and the management of perceptions will require the effective provision of information on monitoring results.

The ISF will be used as a critical piece of sediment management infrastructure allowing much of the upstream sediment to settle prior to discharge, which will be controlled to ensure compliance with the applicable mixing zone boundary upstream of Paupe (the point at which determined water quality criteria must be met). Modelling also predicts that Project related suspended sediment concentrations in the Sepik River will remain comparable to existing conditions.

The Project is committed to ongoing regular engagement in villages downstream of the mine and ISF to address concerns about the environmental integrity of the waterways on an ongoing basis. A key consideration in the design of the ISF embankment is to ensure that the main containment dam will be constructed to endure a probable maximum flood and earthquake scenario. The following measures will be implemented for the extremely unlikely event of a dam break:

- Early warning surveillance monitoring of ISF embankment.
- Alert and communication system and procedures for potentially affected communities.
- Evacuation plan for the site and potentially affected communities.
- Emergency support plan for essential services to affected communities.

It could be expected that community anxiety about water quality and personal safety will remain heightened in the early years of the project (though declining over time), which would have an effect on community and personal well-being. The residual significance is assessed as **low**.

Table 9.13 presents the residual risks with medium or higher significance ratings for Social Catchment 2.

Table 9.13 Residual Risks for Social Catchment 2

Threat	Impact	Project phase	Likelihood/ consequence	Risk rating
SV1 - The capacity to support subsistence livelihoods				
Project discharge/emissions that exceed guidelines and / or inappropriate waste disposal pollute land and / or water resources	Food sources are affected by pollution of land and / or water resources	C, O, PC	Unlikely / moderate	Medium
SV2 - Opportunities for participation in the cash economy				
Perceived reduced share of Project benefits and/or preferential employment given the change to road access rather than barging during operations	Perceived loss of income and employment leads to alienation and social unrest	C, O	Unlikely / moderate	Medium
SV5 - An environment amenable to personal and family health, education, safety and security				
Accident associated with Project vessel movements	Fatality, injury and / or trauma	C, O	Unlikely / critical	High

Note: C – construction; O – operation; PC – post-closure

9.5.6 Social Catchment 3: Sandaun and East Sepik Provinces

The location of all components of the Project and a majority of the Project's designated points of hire are within Sandaun and East Sepik provinces.

In relation to the status of social values centred on livelihood, the subsistence base of Social Catchment 3 is robust given favourable seasonal conditions. However, there is limited opportunity for communities in Sandaun and East Sepik provinces to participate in the cash economy. Historically, opportunities for migration to participate in the labour market in other areas of PNG have been important for income generation in these provinces. With regard to personal and community well-being, services (policing, education and health) in these provinces are limited at best, and non-existent in the more remote areas.

Based on the Project location and activities, it is expected that only social values centred on livelihoods and personal and community well-being will be impacted. A description of the general drivers of societal change that have the potential to impact these social values in Social Catchment 3 is provided below.

Livelihoods - The capacity to support subsistence livelihoods (Social Value 1) and the opportunity to participate in the cash economy (Social Value 2)

FRL will seek to recruit the majority of its workforce from PNG with a preference to employ from Sandaun and East Sepik provinces. During the operational phase the Project will generate approximately 2,430 full time equivalent positions per year, of which a majority (estimated at 90%) will be occupied by PNG nationals. This will have the effect of generating substantial indirect employment across PNG as increased incomes lead to increased demand for other goods and services. The projected cumulative changes in local provincial and regional real gross domestic product and real income as a result of the Project from 2020 to 2060 (ACIL Allen, 2018) are shown in Table 9.14.

Table 9.14 Projected cumulative change in local, provincial and regional real GDP and real income as a result of the project, relative to the reference case (in 2018 terms)

Region	Real GDP (Kina million, 2018 terms, 2020 to 2060)	Real income (Kina million, 2018 terms, 2020 to 2060)
Sandaun and East Sepik	83,554	39,247
Rest of Momase region	7,210	17,297
Rest of PNG	5,737	28,180
Total PNG	96,500	84,723

A preferential employment system will be implemented to maximise local employment. However, candidates will be required to possess the relevant skills and experience to fulfil the requirements of each role. It is likely that many job aspirants throughout the Sandaun and East Sepik provinces will be unable to access employment opportunities due to not meeting required educational criteria, which could to be a source of frustration and disappointment, inducing a level of resentment toward FRL and/or major contractors servicing the Project. However FRL will implement a comprehensive training and development program to support local and regional employees transition through skills levels. Access to this program will be dependent on candidates meeting the requisite literacy and numeracy skills and successfully completing an aptitude-based selection process. Improved national human capital from training and work opportunities in the Sandaun and East Sepik provinces has the potential to result in reduced dependence on foreign workers and provide improved quality of life and life choices for those trained and experienced individuals. This will also increase the pool of trained and experienced workers with skills able to be applied to other resource projects, or transferred to other industries.

Personal and community well-being - An amenable environment (Social Value 5) and the availability of services supportive of personal health, education, safety and security (Social Value 6)

The Project's host provincial governments will experience increased provincial wealth as a result of revenue streams including:

- Mineral royalties. Negotiated by the National Government with host provincial governments, landowners and, in some cases, the relevant LLGs and other affected communities, as determined through the government led benefit distribution process.
- Dividends on Project equity. The State has the right to acquire up to 30% equity in the Project. This will be negotiated and formalised through a State Equity Acquisition Agreement.

Similarly, provincial constituents will experience increased access to wealth through wages directly from the Project and indirectly through association 'spin off' business opportunities. Effective revenue management at all levels will be required if the well-being of provincial residents is to improve. The Project will also support the objectives of the Extractive Industries Transparency Initiative regarding accountability and transparency.

The TCS was implemented in PNG in 1992 and is widely considered one of the most effective development funding schemes in PNG. Through the TCS, certain agreed development projects funded by resources companies earn a tax credit, with approval by provincial and national governments. Filer (2007) noted that the TCS had an added advantage for resource developers, enabling them to finance development projects for stakeholders who were in greatest need (irrespective of the project's impacts) and/or who posed a threat to the developer's harmonious operation. While the TCS is currently suspended during the PNG Government's review of its

operation, given the level of underdevelopment in the Project's areas of influence, particularly Sandaun Province, the Project will endeavour to utilise the TCS to fund social and infrastructure development projects on the assumption that it is continued in some form. Additionally, the TCS may be focused at specific target areas such as women's empowerment.

9.6 Social Considerations for Project Closure

The approach to closure is based on a recognition that the direct benefits of the Project (employment, incomes, skill development, royalty flows, supply contracts, etc.) will cease at closure, particularly FRCGP closure. However, with effective planning and implementation of sustainable local and regional economic development programs throughout the life of the Project, in conjunction with targeted closure programs that equip the community for post closure living, Project-affected communities in particular should have the means for successful transition to other monetary or subsistence livelihoods. The desire to balance the short-term and long-term benefits of the Project to local villagers will be a key social challenge for FRL.

Conceptual FRCGP and FRHEP closure plans have been prepared for the Project (Appendix 3). These consider both environmental and social aspects of closure. The FRCGP is currently expected to close after 33 years, though further exploration in the area may result in mine life extension. The FRHEP is expected to have an operational life of at least 100 years and will provide a long-term supply of hydroelectric power well after the FRCGP closes.

Once a decision to close the FRCGP is taken and the decommissioning and closure process is put in place, income streams derived from the Project will fall, and eventually cease, as mine production and associated employment levels reduce. This will affect Social Catchments 1A and 1B in particular, as they are located closest to the mine area and are likely to have a high percentage of villagers employed by the Project, as well as being in receipt of other financial flows, such as royalties and compensation payments, which will cease. Revenue flows to the Sandaun and East Sepik provincial governments will also be reduced as business activity dependent on the expenditure of wages paid to workers resident in the provinces decreases.

The reduction in mine employment in the lead-up to closure will pose a social risk during the closure process. To address this risk in advance of closure, FRL will develop a supplement to the Human Resources Plan (at least five years prior to closure) that includes retention strategies for personnel required for closure and rehabilitation activities, and will investigate employment transition strategies, including training, for locally employed staff. Employee retrenchment will be in accordance with applicable legislation and the PNG mine closure policy and guidelines (MRA and DMPGM, 2015).

Socio-economic mitigations implemented through the life of FRCGP will aim to address the potential for over-reliance on the operation and plan for development programs which are self-financing following closure. While FRL can encourage people to take measures to ensure that some benefits of the Project are invested in ways which may provide for their needs after the FRCGP closes, it cannot dictate how this is done nor force people to do it. Likewise, while FRL can provide guidance and encouragement for the use of Project benefit streams to be invested in ways which do not rely on the Project in the long-term, and therefore increase the potential for them to remain viable after Project closure, it has no means to control this.

Human capital development through training is an aspect that FRL can directly influence during the life of the Project which can have sustainable long-term benefits. The proposed 30-plus year operating life of the FRCGP allows sufficient time for FRL to establish comprehensive training programs for the local workforce that will provide employees with skills that will provide them

employment during the Project, and allow them the option to transfer those skills to work on mining (or other) projects elsewhere after the FRCGP closes, should they choose to do so. The experience of former employees of the Panguna and Misima mines is relevant, as comprehensive training programs during the life of those mines allowed highly skilled workers to gain employment at other PNG mines and elsewhere after both of those mines closed (Jackson, 2012).

The closure of the Project will also require the transition, from FRL to another entity, of responsibility for the management of infrastructure agreed to be retained following closure. In anticipation of local level governments taking on management responsibility, FRL will consider programs to enhance the capacity and funding of the local level government(s) to plan and budget for infrastructure maintenance during the Project and in the lead up to closure.

An SIA will be conducted at least five years prior to FRCGP closure as a component of closure planning. The SIA will provide a pre-closure baseline that can be used to develop social completion criteria with appropriate local performance indicators, related to aspects such as health, education, household incomes and social harmony, that can inform the management of closure impacts.

Environmental Impact Statement
Sepik Development Project