Cumulative Impact Management Strategy (C14 - CIMS)

Prepared for:

MMERE, MECDM, WB, ADB

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17 April 2023

Preparation, Review and Authorization

Rev #	Date	Prepared by	Reviewed by	Approved for issue by
1	01 Nov 22	GA	FC, JM	JM
2	10 Feb 23	NT, GF	GA, FC	JM
3	14 Mar 23	NT, GF	GA, RM, FC, MD	JM
4	14 Apr 23	NT, GF	GA, FC, RM, MD	JM

Issue Register

Distribution List	Date Issued	Number of Copies
World Bank Group	17 Apr 2023	Electronic / 1 PDF Copy
SIG MMERE	17 Apr 2023	Electronic / 1 PDF Copy
SIG MOFT	17 Apr 2023	Electronic / 1 PDF Copy
LTA (Norconsult)	17 Apr 2023	Electronic / 1 PDF Copy
ADB	17 Apr 2023	Electronic / 1 PDF Copy

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Acronyms

ADB	Asian Development Bank
CBSP	Community Benefit Share Project
CESMP	Construction Environmental and Social Management Plan
CI	Cumulative Impact
CIMS	Cumulative Impact Management Strategy
CLOs	Community Liaison Officers
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Safeguards
GAP	Gender Action Plan
GRM	Grievance Redress Mechanism
HEC	Hyundai Engineering Corporation Limited
IFC	International Finance Corporation
LTA	Lenders' Technical Advisor
MASL	Meters above mean sea level
MECDM	Ministry of Environment, Climate Change, Disaster Management, Meteorology
MMERE	Ministry of Mines, Energy and Rural Electrification
NGO	Non-government Organisation
OE	Owner's Engineer (Stantec New Zealand)
PO	Project Office
RCIWG	Regional Cumulative Impacts Working Group
SDGs	Sustainable Development Goals
SEBS	Social-economic Baseline Survey
SECP	Stakeholder Engagement and Communication Plan
SIEA	Solomon Islands Electricity Authority
SIG	Solomon Island Government
SOE	State of the Environment Report
THL	Tina Hydropower Limited
TRHDP	Tina River Hydropower Development Project (the Project)
VEC's	Valued Environmental and Social Components
WB	World Bank

1 Introduction

1.1 Purpose of the CIMS

Cumulative impacts could jeopardise the sustainability of the Tina River Hydro Development Project (TRHDP) and reduce positive environmental and social outcomes. The overall objective of this cumulative impact management strategy (CIMS) is to provide a basis for the management of cumulative environmental and social impacts and the risks they create for TRHDP.

The following lender-approved documents are relevant to the CIMS:

- the project Environmental and Social Impact Assessment (ESIA) prepared in 2017.
- the Construction Environmental and Social Management Plan P1 (CESMP), and
- the associated management plans (listed in Table 1) which outline detailed activities, timing, responsibilities and performance targets for specific types of environmental and social impact.

The CIMS takes a strategic approach to set out the issues and principles for a multi-party approach additional to and across these Environmental and Social Management Plans (ESMPs).[1] The primary goal of the CIMS is to assess and act on cumulative project impacts in a collaboration between multiple layers of government, private sector operations, civil society and affected communities, over time, and consistent with the findings of the ESIA.

1.2 Definition of Cumulative Impacts

The IFC and the International Association for Impact Assessment[2] identify that while the environmental and social impact assessment process is essential for identifying and managing the environmental and social impacts of projects such as TRHDP, the process is often insufficient for identifying and managing incremental impacts and complex changes caused by multiple human activities and natural processes over time.

Taken together, the impacts from multiple sources of existing, planned and reasonably foreseeable developments, activities, or change processes can have wider implications for project contexts and project impact areas. It is therefore important to identify and understand the cumulative environmental and social impacts of the TRHDP from multiple sources alongside the analysis and management of impacts identified in the more focused TRHDP project management plans (Table 1), and to plan and take necessary actions in response.

[1] See Franks, D.M., Everingham, J. & Brereton, D. (2012) Governance Strategies to Manage and Monitor Cumulative Impacts at the Regional Level. Final Report ACARP Project C19025. Brisbane: Centre for Social Responsibility in Mining, University of Qld.
[2] IAIA (2017). Cumulative Effects Assessment. Fastips 16. https://www.iaia.org/uploads/pdf/Fastips_16%20Cumulative%20Effects%20Assessment_1.pdf

Table 1: List of Environmental and Social Impact Management Plans.

Number and name of plan	Responsibilities for implementing the plan
P-1 Construction ESMP	HEC
P-2 Biodiversity Management Plan	HEC
P-3 Stakeholder Engagement and Communication Plan	THL
P-4 Human Resources and Labour Management Plan	HEC
P-5 Influx Management Plan	HEC
P-6 Grievance Redress Mechanism	THL Governance Lead
P-7 Security Management Plan	HEC
P-8 Worker's Health and Safety Plan	HEC
P-9 Workers Code of Conduct	HEC
P-10 Community Health and Disease Vector Management	HEC
P-11 Traffic Management Plan	HEC
P-12 Waste Management and Point Source Pollution Plan	HEC
P-13 Hazardous Materials Management Plan	HEC
P-14 Spill Prevention and Emergency Response Plan	HEC
P-15 Air Quality Management and Dust Control Plan	HEC
C-1 Cultural Heritage Management Plan	
C-2 UXO Management Plan	HEC
C-3 Forest Clearance Plan	HEC
C-4 Post-construction Rehabilitation and Revegetation Plan	HEC and Rehabilitation Consultant
C-5 Quarry Management Plan	HEC
C-6 Reservoir Preparation Plan	MMERE
C-7 Water Supply Replacement Plan	HEC
C-8 Watercourse Crossing Management Plan	HEC
C-9 Spoil and Topsoil Management Plan	HEC
C-10 Drainage, Erosion and Sediment Control Plan	HEC
C-11 Drill and Blast Management Plan	HEC
C-12 Stormwater Management Plan	HEC
C-13 Noise and Vibration Management Plan	HEC
C-14 Cumulative Impact Management Strategy	SIGOV, PO
M-1 Suspended Sediment Monitoring Plan	HEC
M-2 Water Quality Monitoring Plan	HEC
M-3 Fish, Algae, and Macro-Invertebrate Monitoring Plan	HEC
M-4 Social Impacts Monitoring Plan	PO & THL E&S Managers

M-5 Flora and Fauna Monitoring Plan	HEC
M-6 Construction Works Monitoring Plan	HEC
M-7 Air Quality and Noise Monitoring Plan	HEC

1.3 TRHDP Overview

The Tina River Hydro Development Project (TRHDP) is located on the island of Guadalcanal in the Solomon Islands near Honiara, the capital and main centre of population (Figure 1). The project consists of a 53-meter-high Roller Compacted Concrete dam located on the Tina River in an uninhabited area of Malango Ward at an elevation of approximately 122 meters above sea level (masl) and roughly 30 km upriver from the sea. It incorporates a 3.3 km tunnel to a powerhouse and a tailrace at elevation 73 masl. The reservoir formed by the dam will extend upstream approximately 2.6 km and will have a surface area of about 28 ha at an elevation of 175 masl. The powerhouse will be located 5.4 kilometres downstream from the dam on the left (west) bank of the Tina River, and water will be diverted to the powerhouse from the reservoir through the underground tunnel. Initially, the powerhouse will have 3 turbine/generator units, each with a capacity of 5 MW, allowing a maximum discharge of about 18 m3/s and a minimum discharge of 2.4 m3/s. An environmental flow of 1 m3/s will be maintained between the dam and the powerhouse tailrace, a distance of 5.7 km.

Construction activities will last three years, commencing in 2022, and all construction activities will take place on the ‘core land area’ which was acquired for the Project from the 5 customary land-owning tribes in 2014, as well as along the Black Post Road. The Tina Core Land Company, a joint venture between customary landowners and the government, now has the perpetual title to the Core Area, including the access road from the power station to the dam site.

Figure 1: Map of the project area.

Environmental and social management plans were prepared by the project to meet the requirements and agreements of the project lenders including the World Bank (WB) and the Asian Development bank (ADB). Important parties in implementing the system of environmental and social safeguards (ESS) are the SIG's Project Office (within the Ministry of Mines, Energy and Rural Electrification), Tina Hydropower Limited (THL), a special project company contracted by the Solomon Islands Government (SIG) to build, own and operate the project, and Hyundai Engineering Corporation Limited (HEC), who are contracted to construct the Project. The Solomon Islands Electricity Authority (SIEA), trading as Solomon Power, also has a key role being responsible for the design and construction of the transmission line and the sale of electricity.

The project detailed description, ESMPs and their reporting processes are listed and described in detail in P1, the Construction Environmental and Social Management Plan (CESMP). This Cumulative Impacts Management Strategy (CIMS) adds to this set of documents.

The strategy sets out a system for identifying and responding to activities and projects that are additional to TRHDP, potentially causing cumulative impacts that pose risks to the ability of the project to maximise net positive outcomes. The document is laid out as follows:

Chapter 2 of this document describes the environmental and social context of the project and known potential sources of cumulative impacts, with a summary table of the sources, impacts and likely risks posed, and a list of cumulative impact issues. Further details about

the sources of cumulative impacts are provided in Appendix A. Further details of cumulative impact issues are provided in Appendix B.

Chapter 3 describes actions to address cumulative impacts, with a summary and then detailed descriptions.

2 Contextual Issues and Potential Sources of Cumulative Impacts

2.1 Geographical Context

The environmental and social context of the project is vital to developing a CIMS including identifying nearby areas where TRHDP impacts could overlap with other potential impact sources. Because of the different nature and distribution of the various potential environmental and social impacts, the cumulative impact context is taken to be the Tina/ Ngalimbiu River catchment, plus the additional social impact areas as described in the ESIA. The ESIA and Baseline social survey conducted since then are the primary resource documents for the CIMS.

The TRHDP is located in the Tina/ Ngalimbiu River basin on the north side of Guadalcanal Island, Solomon Islands. The Tina River emerges from the highest elevation mountains of the island's centre and flows north to the sea. The total catchment covers an area of 150 km^2. Elevation of the catchment decreases in a downstream direction toward Tenaru Bay/Iron Bottom Sound.

For the 2017 ESIA, the river was divided into three main reaches: upper, middle and lower. These reaches are also relevant to potential cumulative impacts and are broadly distinguished by their elevation, remoteness/accessibility, degree of forest cover or disturbance, and occurrence of human settlement. The main features of each of these areas, where cumulative impacts are anticipated to occur according to the ESIA and as used in this strategy are as follows.

Upper Tina River Catchment

The Tina River upper catchment ("upper Tina") is characterized by headwaters of densely forested mountainous terrain, with peaks ranging up to 2300 masl. Approximately 60% of the catchment is higher than 800 masl. The upper Tina is the area upstream of the proposed TRHDP dam and reservoir outside the acquired core land. It covers an area of 125 km2 and represents 83% of the total Tina/ Ngalimbiu catchment area.

The upper Tina catchment is comprised of undisturbed montane forests and aquatic ecosystems. The river itself is characterized by sequences of pools and rapids and sharp meanders within a narrow, steep sided gorge.

The upper Tina River includes the junction of the Vohara River, the Mbeambea River, and the tributary Njarimbisu River. While used for occasional fishing and hunting expeditions by the indigenous Malango people who now live downstream, and by those using ancient bush trails through the mountains to the Weather (southern) Coast, these sub catchments and feeder streams in the upper Tina are very difficult to access.

Middle Tina River Catchment

The middle reach of the Tina River ("middle Tina") is defined as the stretch of river downstream of the dam to the confluence of the Tina and Toni Rivers and includes the 5.7 km section that will be bypassed by the diversion of the river flow through the headrace tunnel.

The upper part of the mid-Tina is dominated by a steep-sided gorge and moving down the river toward the Tina-Toni confluence, the slopes gradually become less steep and are dotted with a few small human settlements and food gardens on both sides of the river. The surrounding slopes show signs of recent and historical commercial scale logging. Sizeable villages are found along the western ridge and its spurs, alongside the main access road that originates at Black Post.

Lower Tina River/Ngalimbiu River

The Tina River joins the Toni River 17km downstream from the Tina River's headwaters. The Toni River is a much smaller, with a catchment area of roughly 45 km2 and flows that are 1/3 that of the Tina River. From the confluence of the Tina/Toni River, the river becomes the Ngalimbiu River, which widens out and flows, with meanders, through a coastal plain before discharging into Tenaru Bay in Iron Bottom Sound, on Guadalcanal's North coast.

The Ngalimbiu River flows across an area characterized by denser human settlement and human activities, such as agroforestry, agriculture, gravel extraction, and fishing. Drainage from agricultural lands, such as the oil palm plantations, enters the river. A small delta has formed at the mouth of the Ngalimbiu River where it enters the Solomon Sea at Lasa Point. The coastal communities' members belong to the Lengo cultural group which is distinct from their upstream inland Malango neighbours. Their traditional livelihoods are based on fishing and agriculture.

2.2 Environmental Conditions

From the available regional data, it is estimated that annual rainfall in the upper Tina River headwaters is in excess of 3500 mm and over 2500 mm at the dam site. Average daily temperatures in Guadalcanal range from 22°C to 31°C throughout the year, with high humidity.

Floral surveys identified159 plant species in the project area: 5 are listed as vulnerable, and 19 are listed as threatened. Sixty six species of trees, fern trees and palm trees were identified. Many species are regrowth and secondary tree species and good indicators of past (natural and/or anthropogenic) disturbances. At least 23 identified tree species are of commercial timber value. A total of 36 shrubs and vines, and a total of 57 herbaceous plants were identified.

The upstream area is dominated by highly valued, undisturbed lowland forests, whereas, the middle reach near Choro, (the southernmost hamlet in the catchment), is dominated by disturbed forests. This is mainly the result of previous settlements, gardens, trails, and more recently, logging. However, even though the forests are disturbed, they still show rich plant diversity, which is a factor of rapid vegetation regeneration.

In the project area wildlife studies recorded 9 amphibian species out a total of 13 potential species; 5 reptile species out of a total of 23 potential species; 41 bird species out of a total of 67 potential species previously recorded; and 5 mammals out of a total of 14 potential species.

Overall, the ESIA (2017) for the TRHDP notes that "no critically endangered or endangered terrestrial or aquatic species have been found within the project affected areas", and that the

area does "not support any areas associated with key evolutionary processes or globally significant numbers of migratory or congregatory species". (p276).

2.3 Social-Economic/ Community Conditions

The TRHDP social baseline study area consists of over 30 villages and hamlets of mainly Malango indigenous people originating from the central Guadalcanal Mountain lands, several official "settler" villages made up of people originating from South Guadalcanal/Weather Coast, and in the lower catchment, well-established settlements of Lengo people in West Ghaobata Ward.

Settlements range in size from two-house hamlets in the hinterland up to villages with dozens of houses and over a hundred residents. Most hamlets in the study area are connected together by walking tracks and in some cases by dirt roads, which are prone to becoming impassable during wet weather. In recent years, settlements have been established along the main Bahomea (Black Post) access road that turns up the western ridge of the Tina Valley. In the past 10 years, hamlets and clusters of houses have also appeared adjacent to the northern section of Black Post Road in what was historically a coconut and cocoa plantation.

There is no official data available from the National statistics office on the 2019 Census that would accurately tell us the population situation in Malango Ward or West Ghaobata ward (which together approximate the project social impact area). In 2009 the population of Malango Ward was 10,532 and West Ghaobata 4,515. In 2019 population growth in Guadalcanal Province was in the order of + 3-4% per annum. The area has therefore been experiencing increasing pressure on land for food production and natural resource harvesting, increasing demand for employment and cash income, associated increased consumption of imported goods (especially food), and significant pressure on infrastructure and social services. Self-relocation of some river-side settlements in the middle and lower catchment has also occurred in the TRHDP planning period due to flooding.

2.4 Potential Sources of Cumulative Impacts on TRHDP

There are a number of current projects, future activities and unplanned changes whose ecological, economic and social impact areas potentially overlap in time and space with the environmental and social context of TRHDP. Combined with any residual impacts generated by the TRHDP (after management by the CESMP), the residual impacts of any of these activities or changes have the potential to create cumulative impacts creating risks for achieving desired project outcomes. The sources of potential cumulative impacts as currently understood are summarised in Table 2 and detailed in Appendix A. They include:

- Present and future gold mining activities,
- Commercial harvesting of timber,
- Oil palm production,
- River gravel extraction,
- New enterprises, commercial agricultural and horticultural projects
- Infrastructure developments
- Unplanned expanded settlements and new settlements
- Natural hazard events.

The map in Figure 2 (below) provides an overview of the regional setting of the TRHDP and the location of the project footprint, rivers, activities, and settlements referred to below.

Where there are possible cumulative effects from these sources of change combined with those of TRHDP there could be requirements for collaborative responses in terms of impact monitoring between project management and relevant agencies. Actions could include, for example, additional monitoring sites, frequencies and parameters, or additional surveys covering wider areas. These expectations are part of the measures designed in Chapter 3 of this strategy.

It is also important to note that this CIMS is flexible and proactive in approach, which is necessary to accommodate any additional sources of information about cumulative impacts that are identified through collaborative investigations and anticipatory actions as outlined in chapter 3. It is anticipated in this strategy that these investigations are ongoing, providing an enhanced understanding of cumulative impacts over time, alongside increased capability in environmental management. The content of Table 2 therefore should be reviewed and updated at least annually.

Table 2: Summary of Potential Sources, and Characteristics of Cumulative Environmental and Social Impacts in TRHDP area.

Source of change	Owner/developer	Status	Location	Impact	Likelihood Magnitude and Risk* of the Impact	Timing
Gold mining open pit and underground)	Gold Ridge Mining Ltd	Active, possible expansion into prospecting licence area	Gold Ridge mining licence area Mining licence ML 1/1997. Prospecting licence area 02/14 -overlays part of Tina catchment (upper and middle section)	Demand for labour and skills; influx/population increase; physical displacement and resettlement; increased cash incomes; royalty payments; livelihoods change, land use & spatial conflicts, increased load on infrastructure; social/cultural conflict, reduced local amenity, reduced river water quality, and sedimentation downstream incl. coastal area, loss of natural forest, safety risks.	Medium likelihood, medium impact Risk: medium	Until 2043
Gold mining (alluvial)	Win Win Investment SI Ltd	Active	Tuarana, east of Gold Ridge. Outside TRHDP area	Increased demand for labour and skills; influx; increased cash incomes; royalty payments; livelihoods change, land use & spatial conflicts; social/cultural conflict, reduced local amenity, reduced river water quality and sedimentation downstream incl. coastal area;	Low likelihood, Low Impact Risk: low	Until 2023
Oil Palm production	Guadalcanal Plains Palm Oil Ltd (GPPOL)	Active	Lower catchment/plain, downstream of the project	Demand for local labour, paid employment, livelihoods changes/loss of diversity, royalties, dividends and rents to Lengo owners (SBD7.2 million in 2018); smallholder cash cropping of oil palm; water pollution downstream; expanding area with increased out-growers; biodiversity loss, reduced food production; potential for social & cultural conflicts.	medium likelihood, low impact Risk: low/medium	Ongoing at least to 2070s
Commercial logging	Multiple logging companies and customary landowners	Active	Upper and mid catchment adjacent to TRHD Core Area (despite legal restrictions to <400 M below SL)	Employment, royalties for landowners, cash income; timber supply increased; improved access to remote areas; loss of natural tree cover, increased natural hazard risk (erosion, landslips, waterway sedimentation), damage to gardens and water sources; reduced availability of construction and craft materials; biodiversity/ecosystem loss, livelihood change, landowner/social conflicts Log-truck traffic on local and Black Post Rds.	Medium likelihood, high impact Risk medium/high	Ongoing, ad hoc

Source of change	Owner/developer	Status	Location	Impact	Likelihood Magnitude and Risk* of the Impact	Timing
Commercial river gravel extraction	several operations on Ngalimbiu River	Active	Lower catchment/plain - Lengo area	Availability of construction materials; royalties for customary landowners, greater livelihoods security; river sedimentation downstream.	Low/medium likelihood, low impact Risk: Low	Ongoing
Commercial agricultural and horticultural projects	WB/USAID funded agricultural developments (SIG/MAL agriculture and rural sector transformation (ART)project)	Planned	Lower catchment/plains, potentially mid catchment	Increased local and domestic food production; reduced dependence on imported food; cash income for farmers, employment for women; environmental hygiene, health, and safety issues from waste products and wastewater; increased pesticide and herbicide use; water quality issues; competition for land, land use change and potential for conflicts, demand on infrastructure.	Medium likelihood, low impact. Risk: low	2024 on
Facilities and infrastructure development	John Coleridge Patterson University/theological college (Church of Melanesia)	Planned	Lower catchment/Black Post Road	Cash income from employment, and supply of goods & services; improved livelihoods; increased educational access & facilities; land use change, demand on services & infrastructure (roads); traffic; new settlement/s; influx	High likelihood, medium impact Risk: low	2023 on
Unplanned settlements	individual households	Unplanned, active	Middle and lower catchment	Population influx, increased market for goods & services, increase in local labour supply; competition for paid employment, demand/pressure on services and infrastructure, traffic; land demand; social and cultural conflict;	High likelihood, medium impact. Risk: medium	Ongoing since 2000.
Natural hazard events	Nature	Active and increasing	Whole catchment	Climate change (increased frequency of tropical cyclones, increase in severe storms, increased drought; greater vulnerability/danger for communities; potential loss of infrastructure/housing; resettlement; food insecurity, changed settlement pattern; economic stress.	High likelihood high impact. Risk: High	Ongoing and increasing frequency

* Risk to positive project outcomes

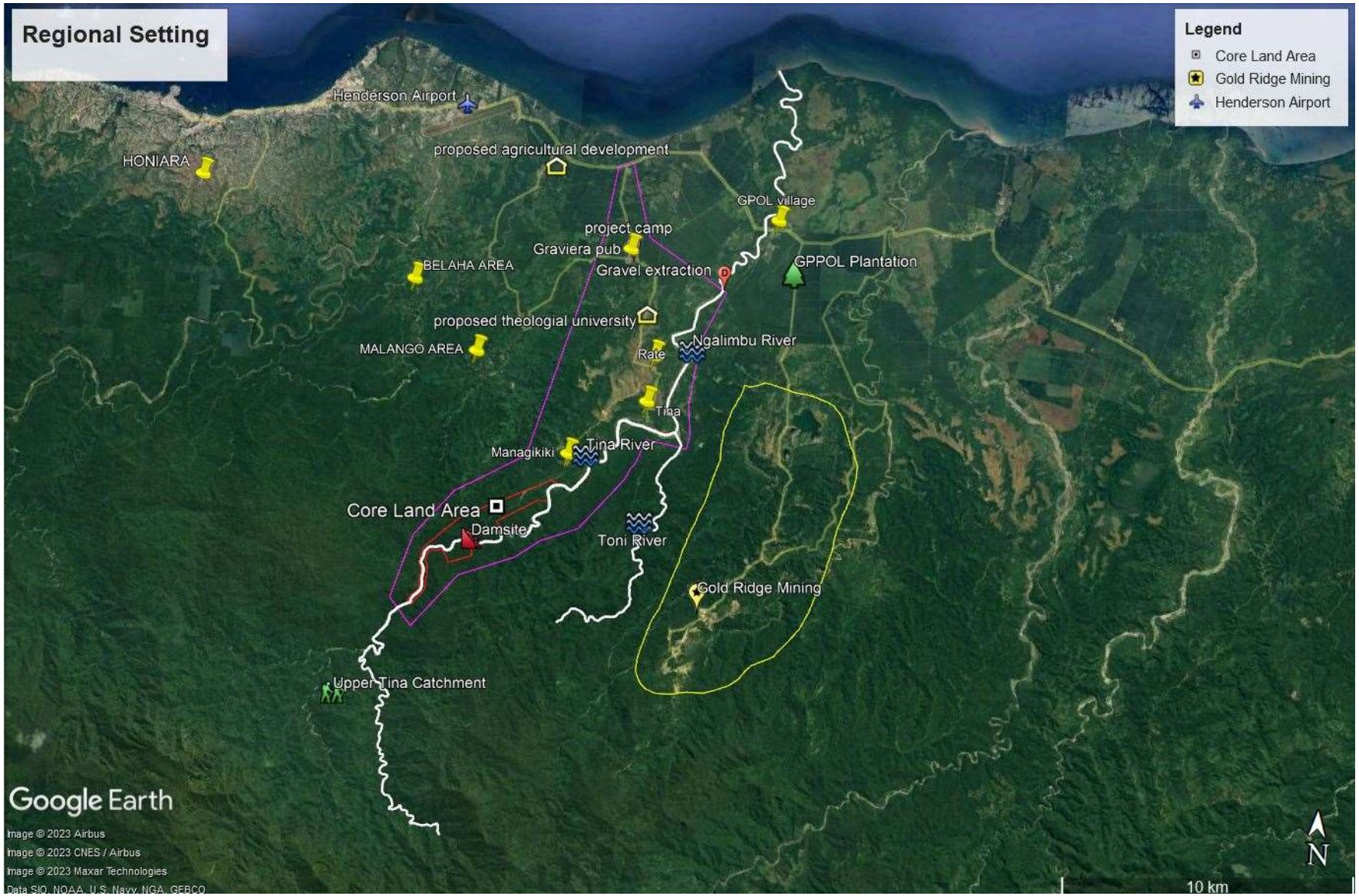

Figure 2: Regional setting of the TRHDP.

2.6 Cumulative Impact Issues

The potential sources of cumulative impacts create key issues for environmental and social change to address through the CIMS. The basis for these issues is drawn from the national environmental reporting framework established by the Ministry for the Environment. Secondly, issues were drawn from the ESIA, ESMPs, social-economic baseline study and associated long-term community engagement for TRHDP. These issues are also subject to management actions under the CESMP and the related ESMPs.

Selection of particular issues here reflects the focus of the ESS system on the most valued aspects of the social-ecological environment. Consistent with the purpose of this strategy these issues are open to further refinement and additions as the project ESMPs and associated actions, including environmental and social monitoring, are implemented.

An important additional source of information about key issues to address in this CIMS is the Solomon Islands State of the Environment Report (SOE) prepared in 2019.[3] This report identifies the following important components of the national environment and society:

- Culture and Heritage: traditional knowledge and practises, language, diets, sites,
- Atmosphere and Climate,
- Coastal & Marine offshore fisheries, state of special marine species, seagrass & coral reefs, protected marine areas, coastal fisheries, coastal water quality,
- Freshwater resources: access to freshwater, water quality (sedimentation, turbidity, heavy metal and faecal pollution),
- Land (forest harvest, livestock production, area under cultivation/crops, mining area)
- Biodiversity (threatened species, invasive species, forest cover, protected areas),
- Built Environment: (waste generated & disposal, energy, sanitation, health respiratory, skin, malaria).

Usefully, the reporting process for the SOE framed the key issues in terms of the United Nations Sustainable Development Goals (SDGs) as the basis for assessment. Key challenges and drivers of change for the nation were documented in the SOE as:

- Population growth, density, and distribution,
- Economic underdevelopment, the need to increase per capita income - logging, fishing, and agriculture expansion, paid employment, small business, access to transport,
- Climate stability, change and shocks (floods, droughts, cyclones, landslides)
- Tradition/ kustom – language and identity, competition, conflict, tribalism, westernisation/modernism,
- Use of natural resources – forest cover and logging, fisheries (coastal and freshwater), conservation areas, urbanisation, mining, clean energy
- Health, sanitation and a healthy diet.

[3] The Solomon Islands 2019 State of Environment Report was led and developed by the Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM), and the Secretariat of the Pacific Regional Environment Programme (SPREP). Content contributions were made by numerous representatives from government and NGOs in a sustained collaborate and consultative process. It also involved the establishment of an environmental data portal hosted by SPREP.

The following cumulative impact issues provide an initial focus for the CIMS in relation to the above sources and ongoing ESMP monitoring, and the investigations and management responses outlined below. Details of the issues are provided in Appendix B. The issues are:

- Water quality in rivers and streams,
- Terrestrial and aquatic habitat and biodiversity loss,
- Changes in land tenure from customary land tenure to alienated land,
- Increased incomes, employment of locals and any influx of job-seeking non locals,
- Pressures on food security and health diets for communities,
- Changes to traditional norms and cultural practices,
- Substance abuse and increases in crime,
- Visual impacts and loss of a sense of place,
- Population pressure on natural resources such as garden land, wildlife, fish, timber and non-timber forest products,
- Reduced safety and increased damage from more frequent and intense storms, and concerns about dam safety.

3 Actions to Address Cumulative Impacts

3.1 Focus of Proposed Strategy Actions

A cumulative impacts strategy is required because the combined residual impacts (after mitigation, if any) of multiple activities potentially overlap temporally and spatially. Multiple sources of impacts can be one-off impacts or they can arise on an ongoing basis over project construction and operation. Some of these impacts may require additional monitoring and mitigation actions within particular TRHDP ESMPs (internal actions that include affected people) or through the combined efforts of affected persons, stakeholders, various relevant agencies, and the TRHDP PO and contractors in a collaborative approach.

The actions outlined in this chapter of the CIMS therefore necessarily involve TRHDP parties (referred to here as internal measures) as well as external parties (for external measures). Internal measures will take a project-level perspective whereas external measures will adopt a regional perspective and likely involve organisations external to the Project.[4] The measures are consistent with the IFC guidance[5] that the management of cumulative impacts is necessarily an iterative process that integrates the work of multiple disciplinary teams as well as multiple stakeholders from the wider area.

This CIMS recognises that the Project ESIA and ESMPs already form an important part of ESS for TRHDP and are a vital part of the strategy. The high probability that cumulative impacts will occur changes the perspective of impact assessment from a project-centred approach (divided into multiple management plans) to an approach that requires:

- Integration of analysis and response across all areas of impact assessment and management, including different agencies responding, and
- An emphasis on particular resources, areas, ecologies and social groups, especially vulnerable groups – referred to as “valued” components of the social and environmental context. Here the idea of “value” recognises there has been a process of research and analysis, including engagement with affected people and key stakeholders.

Table 3 summarises the proposed strategy as a set of strategy objectives, actions, responsibilities and KPIs, with detailed descriptions of the necessary actions below it.

[4] Furthermore, these link to the State of the Environment monitoring and reporting process which provides a provincial and national perspective.
[5] Refer to IFC’s Good Practice Guidelines: Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets at https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_handbook_cumulativeimpactassessment

Table 3: CIMS implementation.

Objectives	Actions and timing	Responsibilities	KPIs
Integrated documentation and analysis of cumulative impacts across the Project ESMPs	• ESS and GAP Managers review and report on cumulative impacts across Project ESMPs (ongoing) • Hold a cumulative impacts technical & training workshop (year 1)	, HEC, THL, OE, CLOs, PO, LTA	• Training session held on the monitoring and management of cumulative environmental and social impacts for ESS managers and CLOs • Cumulative impacts are discussed in site and project ESS meetings • Cumulative impacts are analysed and documented in ESMP reports
Information on potential cumulative impacts gathered and communicated	• Satellite and site imagery reviewed 6 monthly (human activity, land-use changes) • Logging, mining and exploration licence applications in project area advised to PO (ongoing) • Extreme weather forecasts communicated to all stakeholders (ongoing)	THL, PO, MMERE, MOFR. RCIWG	• Risks identified and communicated internally and externally, including to RCIWG and relevant agencies
Participation and engagement of key stakeholders in CIMS	• Establish communications protocols for CIMS consultation (year 1) • Regional Cumulative Impacts Working Group (RCIWG) formed (year 1)	PO, ESS Managers, GAP and CBS managers, CLOs/CLAs, RCIWG	• Participation and engagement of key stakeholders in CIMS and local people and women contribute to cumulative impact identification and solutions over time • RCIWG is formed, meets annually and their data and discussions of cumulative impacts are incorporated into annual reports
ESMP solutions and management strategies are implemented when a cumulative impact is identified	• ESMPs monitor the effectiveness of responses to cumulative impacts (annual) • RCIWG guides PO in development of regional responses/ plans/ strategies (annual)	PO, THL, HEC ESS Managers, OE	• Cumulative impacts and responses are fully identified in ESS reporting by PO
Improved availability of relevant data at multiple levels: national, regional and local government	• PO, reviews relevant data sets for monitoring cumulative impacts of TRHDP (ongoing) • Agencies with relevant data share data sets with TRHDP through PO (ongoing) • The national data portal provides useful sets of data	PO, MEDCOM, RCIWG	• Improvements in the availability and performance of relevant data sets external to the TRHDP and useful to assess wider project impacts

3.2 Detailed Strategy Actions

Potential cumulative impacts can arise from TRHDP activities when combined with the impacts of other developments in the project area, or in the vicinity. This CIMS provides measures to identify and address cumulative impacts across the Project ESMPs: a) measures that are internal to the TRHDP and assessed and managed within the project ESMP structure, and b) measures that are external to the project and assessed through collaboration between TRHDP, managers of the nearby projects, and relevant central and provincial government agencies.

Internal actions

The focus on cumulative impacts from TRDHP means that the proposed actions are, in the first place, actions are in addition to, and fully integrated with, the ESMP framework established by the Construction Environmental and Social Management Plan (CESMP-P1). The CESMP guides the individual ESMPs, strategies and plans (including this CIMS) and the required system of monitoring and audits across these plans. The responsibilities of HEC, THL, the OE and PO in monitoring and managing impacts are set out in the CESMP including coordination, reporting and audit mechanisms, such as regular on-site meetings, and monthly and quarterly reporting. HEC prepares comprehensive quarterly environmental and social safeguards reports for THL. The PO is responsible for compiling semi-annual environmental and social management reports to lenders. The internal measures of this CIMS therefore recognise that the assessment of cumulative impacts is a necessary and integral part of all of the combined impact assessment and ongoing monitoring of TRHDP.

The key additional analytical tasks are for the ESMPs managers working together to identify if and how the impacts of TRHDP combine cumulatively with the actual and potential impacts of other activities, current and proposed, and with other natural stressors such as extreme climatic events. As noted above, past sources of change and underlying trends are assumed to have been already included in the baseline analysis for the ESIA.

CIMS actions to implement internally are:

A1 HEC, THL and the PO should consider how all impacts being monitored or otherwise identified during TRHDP construction and operation might be cumulative and consolidate information on these impacts. The point where PO compiles their semi-annual reports is a key point for reviewing, understanding and discussing project cumulative impacts, while POs annual reports to lenders are the key reporting points. When considering cumulative impacts the HEC, THL and PO ESS managers together should: (i) identify all the sources of the impact and any other additional influences affecting the cumulative impact, (ii) assess the significance of the impact and (iii) determine the appropriate response, either as already undertaken or as proposed for immediate action in an ESMP. PO should document and report on cumulative impacts and management actions as a specific part of its t annual reporting to lenders. The CIMS annual reports by PO can be based on ESMP reporting as well as observational data and site visits, including concerns about an emerging trend, and breaches of an agreed ESS performance measure as it relates to a cumulative impact identified in ESMP audits. Their reporting should include any trends identified from monitoring data sets, any thresholds exceeded, and observations about underlying changes and trends.

A2 As an extension of A1 actions and reporting, THL/HEC, the PO (lead) the OE and the LTA should meet annually to produce a working matrix of cumulative impacts across TRHDP using the issues identified in chapter 3 as a starting point. This action could be assisted by field visits, observations and imagery. The matrix will identify and document the nature of each cumulative impact, the combined sources, and any resulting consequences for environmental and social components, emphasising any cumulative impacts on vulnerable groups, communities or sensitive environments. All existing, new and proposed actions for additional monitoring or mitigation will be

documented with timelines and responsibilities. The PO will use the information from these meetings and A1 above to compile a short annual report on cumulative impacts as part of ESS reporting to lenders.

A3 ESS and GAP Managers should ensure that implementation of the Stakeholder Communication and Engagement Plan (P.3) incorporates input from affected people regarding the identification of cumulative impacts and the performance of measures developed to mitigate these impacts, noting that cumulative impacts could potentially arise across the full range of project impact management and monitoring as in Table 1 (above).

A4 The PO should provide a list with a timetable, a budget and responsibilities for internal actions on cumulative impacts that are additional to the budgets of individual ESMPs, when the Strategy is operational, including any requests for technical assistance with implementation and any additional costs associated with training, monitoring, imagery, field visits, meetings, and reporting. The budget items should be updated in each annual report on cumulative impacts.

External actions

External actions are necessary to implement the CIMS for the TRHDP, recognising that there is a limited institutional basis in the Solomon Islands for taking a wider, regional perspective on cumulative impacts. Guidance from the IFC requires that TRHDP take the lead on developing this approach to the aggregated impacts of developments in and around their project area. This will require working with multiple stakeholders and affected communities to scan for and provide data on environmental and social changes arising from multiple sources that interact with the TRHDP. Having identified these accumulating impacts, particular agencies will need to consider, and where necessary gather, information on trends or changes for each impact, identify the sources of the impacts and investigate measures requiring a regional response to priority cumulative impacts through government policies and regulations.

Further CMIS actions are:

A5 The PO should (i) gather and communicate Information on potential cumulative impacts from the relevant agencies (e.g. licence applications etc), (ii) establish a Regional Cumulative Impacts Working Group (RCIWG) for TRHDP (iii)convene the RCIWG annually, using a workshop format, for iterative discussions focused on identifying and reviewing cumulative effects, available data sets, and the effectiveness of management strategies, with inputs to RCIWG workshops from relevant Ministries, project CLAs, community representatives, women's representatives, HEC and THL ESS managers, the OE, and the GAP manager, who are all working closely with affected areas, communities and stakeholders. The annual workshop output will be a summary of discussions about ongoing or new data collection and recommendations for specific actions including new technical studies, monitoring sites, and/or a different frequency of data collection to provide an input to annual reporting.

A6 The PO should socialise this CMIS across all relevant agencies, stakeholders, and affected communities including initial capacity building and /training on the monitoring

and management of cumulative environmental and social impacts, with support from the LTA and appropriate TA's.

A7 The PO should work with the RCIWG, relevant agencies and stakeholders to prepare recommendations and budgets for specific tasks when cumulative impacts are identified, to manage these impacts at a wider scale if required. tasks Could include preparing a:

- spatial plan
- housing strategy
- social service delivery strategy
- training and workforce strategy
- transport and infrastructure plan
- marketing and enterprise development strategy, or a
- land, water or conservation plan
- disaster response.

Stakeholder representation on the RCIWG

There is a pool of potential agencies who could provide information relevant to understanding and acting on cumulative impacts for the project. An indication of these organisations is provided by MECDM, which is responsible for regular state of the environment (SOE) reporting. The SOE process has provided an existing and well-considered framework for assessing and reporting on environmental changes at the national and provincial level that could be applied in relation to TRHDP at the regional level. A selection of the stakeholders and contributors to the national environmental reporting should provide a useful starting point for the RCIWG. Members could include:

- MEDCOM – which can also provide data and insight on climate events.
- MMERE, which is both the host of the PO and able to provide information on mining activity
- Ministry of Infrastructure and Development, which can provide data and insight into infrastructure developments, including roading
- Ministry of Culture and Tourism
- Ministry of Lands, Housing and Survey
- Ministry of Health and Medical Services
- Ministry of Forest and Research, which can provide information on forest harvesting activity
- Ministry of Police and National Security
- Ministry of Agriculture and Livestock
- GPPOL
- Guadalcanal Provincial Government
- Solomon Water
- Logging industry representative
- NGOs involved in environment, urban planning, women's development and community development in the Honiara area.

The list here is not exclusive and should be updated and shaped to meet the needs of TRHDP as impacts and mitigation responses change over time. The PO should engage with these stakeholders individually to identify and manage cumulative impacts and involve them in the RCIWG. It may also prove useful to group stakeholders for discussions, in targeted meetings and workshops, for example:

- hydrological and biodiversity impacts;
- infrastructure and services including transport, traffic and safety impacts;
- social, cultural and economic impacts.

It is important that stakeholders continue to work together on the data gaps that were identified in the course of the national SOE reporting, which found a “lack of data and proper documentation in most of the areas that were assessed”. This absence of data is a clear risk to assessing and acting on cumulative impacts for TRHDP

In dealing with cumulative effects, it is always difficult to identify if a particular outcome is the direct result of a particular project or source of change, or of multiple sources. Inadequate data sets amplify this problem.

The TRHDP project monitoring and the PO should wherever possible consider how to obtain and communicate practical and accessible data sets between stakeholders. They should also consider how these can contribute to the development of national data sets. It is notable here that the SPREP project has already assisted with a new Solomon Islands Environmental Data Portal: https://solomonislands-data.sprep.org/.

CIMS reporting and audit of performance

Responsibilities for documenting cumulative impacts and reporting on them lie with multiple parties as described in this strategy. These parties include the ESS managers of HEC/THL and PO, and the PO’s Gender and CBSP Managers. The PO will take the overall lead in reporting on cumulative impacts and CIMS outcomes utilising observational data and particular ESMP reporting points. The PO will consolidate results into their annual safeguards reporting schedule with emphasis on the annual report as the main reporting mechanism for cumulative impacts.

Audit of the performance of the CIMS will be undertaken internally by the OE as set out in the CESMP and annually by the LTA, Norconsult, which is the Independent Environment and Social Monitoring Agent for project construction.

Post-construction, during project operations, it will be necessary to identify an audit body or agency. PO should consult with MECDM to establish this audit process as they are the authority that has been vested with monitoring all the impacts of development in the country.

Suggested key indicators (KPIs) of CIMS performance are identified in Table 3 above.

Appendices

A. Details of Potential Sources of Cumulative Impacts

Gold Mining Activities

Gold Ridge Mining is a long-standing mining operation proximate to the Tina catchment and their prospecting license (SPL194 – Vanusa Tenement) extends over a rectangular portion of the Bahomea area encompassing130 km^2. The lease overlaps with the middle section of the Toni River watershed, and overlays much of the Tina/Ngalimbiu River watershed near the Tina/Toni river confluence. At present, none of the pits, mineral processing or tailings facilities affect the Toni/Ngalimbiu river system, although the customary owners of the mining area are also Malango people.

Gold Ridge Mining's facilities include its Tailings Storage Facility, located on the upper Tinahulu River, which is part of the larger Matepono River catchment, approximately 10.5km to the east, and outside of, the Toni River watershed. The tailings dam contains turbid water with high concentrations of cyanide, arsenic, copper, zinc and nickel, particularly in the sediments, which is not supposed to be released into the Tinahulu River, though there have been unauthorised releases/spills (as recently as 2022). There is quite a long-standing community concern about any potential, spills, major leakage or catastrophic collapse of the tailings dam due to cyclonic storms.

A water quality monitoring program is in place for the Matepono catchment, to confirm whether mine-related contamination and sedimentation is occurring. Fish sampled from the Tinahulu River have shown high concentrations of bio-accumulated metals (silver, arsenic, cadmium, cobalt, copper, mercury, lead and zinc), relative to reference samples. These high concentrations have been attributed to mining activities. Some metal concentrations were potentially detrimental to humans and animals.

Gold Ridge has experienced a history of mine openings, expansions, retractions and closures, along with changes in ownership. The current owners, Wanguo International Mining Group (70%), AXF Resources (20%) and Gold Ridge Landowners through the investment company Goldridger Communities Investment Ltd (GCIL) (10%) have signed a USD 825 million deal with China Railway Group Limited to build and lease a railway system and mining service station. GRML has also begun underground mining operations. Prior to its closure in 2016, the GRM was a significant contributor to the local and national economy. Under its present iteration, GRML has planned to run its operation beyond 2040.

The social and economic impacts of the gold mining operations extend beyond river catchments to the wider Bahomea area. For example, in 2020, it was estimated there were up to 1000 people carrying out "illegal" gold mining at Gold Ridge, including members of settler communities, all of whom have been required to vacate the mine site. The mining has also been a source of community conflict among the Malango landowners over the distribution of royalties. There are some discussions with landowners regarding possible future extension of the gold mining activities. A western extension of the Gold Ridge mine was planned, and new ore pits could open along with the expansion of roads and operational facilities.

To the immediate east of the GRML licence area, Win Win Solomon Island Investment Ltd has been operating an alluvial gold mine in the bed of the Matepono River near Tuarana village in Vulolo ward. An EIS was lodged in 2018 in support of a mining license. The

method is “retreating open pit” – which involves backfilling as the pit progresses. The mine provides some employment and royalties for the landowners and the local community. Conflicts between the mine operators and the local community have been reported recently, and the company has been under investigation for gold smuggling (SIBC, 10/8/2022). Mine operations were planned to continue until 2024.

Timber Harvesting Activities

There is a long history of artisanal and commercial timber harvesting in the Tina River Catchment. Timber resources in the Tina River catchment are either commercially exploited, when a customary landowner sells the timber rights, or selectively harvested by local community members depending on need. Either way, timber harvesting is poorly documented and monitored, and the main source of information on past activity is from comparative analysis of remote sensing imagery.

Artisanal harvesting is usually done by small parties of men using chain saws and portable mills to breakdown the logs onsite, and then carry or float the timber downstream to pickup points. The timber is used for local housing or sold in domestic markets. The 2020 baseline social monitoring survey for the project recorded that 3% of those in paid employment. were employed in commercial scale logging by the Malaysian-owned Galego Resources. However, 25% of households reported receiving income from timber in the previous 12 months and 44% had received royalty payments from logging and/or mining.

No information appears to be available regarding the type or volume of timber harvested, or the total royalties being paid by timber companies to customary landowners. A single timber harvesting license (TIM 2/90A), which is held by the Bahomea Logging Company, is the only license in the Tina River catchment at the time of reporting. Since logging is a poorly documented, policed, and monitored activity, the full extent of both social and environmental impacts is difficult to assess. Commercial logging is regularly in the news over poor harvest practises, environmental destruction, illegal encroachment onto neighbouring land, undisclosed exports, and community conflicts, yet is a significant contributor to the national economy and to the landowners’ livelihoods.

Based on field observations, impacts from selective logging are currently minimal along the banks of the Tina River catchment, whereas many areas along the Ngalimbiu River are prone to landslides, either as a result of naturally unstable slopes or because of past forest clear-cutting or other human activities. Satellite imagery for the Tina and Toni River catchments suggests that commercial-scale logging, including road building, has been conducted above the legal limit of 400 MASL. Subsequent to the announcement of the TRHDP, landowners in the Toni–Tina catchment undertook commercial logging, with extraction occurring through a river crossing at Tina Village and along the Black Post Road.

Commercial timber harvesting will not be permitted within the area of land acquired for the TRHDP. It is expected, however, that local communities will continue to practice small-scale selective timber harvesting, which will be made easier with the new access road. Based on recent history it is also likely that, without more effective enforcement of harvesting controls, commercial scale logging will still occur in the project catchments in the future.

Oil Palm Activities

Guadalcanal Plains Palm Oil Limited (GPPOL, since 2005) has 6,300 ha planted with oil palms, and a mill located on the coastal plain partly within the Ngalimbiu River catchment, and partly within the Matepono River catchment.. The activity of plantation agriculture has a long history in this area dependent on the aggregation of land holdings under lease agreements with Lengo land holding clans. Prior to the devastating Cyclone Namu in 1986, the area was being developed for rice production.

While adjacent private landowners have planted small stands of oil palm to supply to GPPOL, there is limited opportunity for the activity of this plantation agriculture to expand further up the Tina--Ngalimbiu River beyond the current coastal plain. Given the very hilly topography of the upstream area and the issues of land ownership, it is doubtful that expansion will occur in this direction.

Plantation agriculture has a range of social, economic, ecological and water quality impacts: the industry is currently affecting the aquatic ecosystem of the Ngalimbiu River through the use of various herbicides, and water quality in the Ngalimbiu River has been affected by GPPOL's use of chemical soil nutrients. According to Sol-Law Lawyers, monthly water quality sampling of discharges from ponds and watercourses that drain the plantations, is done for BOD, pH, TSS, and Oil and Grease. However, the Ngalimbiu River is not being monitored for pesticides or fertilizers. Also, water quality results are not publicly available. These are examples where additional, proactive monitoring could reduce risks from combined activities.

Social and economic impacts for the area include paid employment (for approximately 1300 Solomon Islanders with preference given to the local coastal Lengo landowners and then Guale people generally). There are historic tensions around lease arrangements and royalties, so the plantations also have an effect on social cohesion in the area. Indeed, the "tensions" conflicts of the late 1990s-early 2000s began at the plantation as a Guale objection to the presence of workers from Malaita.

There is limited work opportunity for women in oil palm and plantations limiting the land available for food gardens and other livelihood activities, therefore reinforcing the shift to a cash economy, and demand for paid employment. In 2022, the Government and the company were keen for GGPOL to expand its operations. (SIBC, 25/3/2022).

Gravel Extraction Activities

Gravel is extracted from the Ngalimbiu River bed material (primarily sand and gravel) to be used as aggregate material in construction activities. As noted in the ESIA, both commercial and small scale extraction takes place along the Ngalimbiu River. There are several commercial scale operations in the lower catchment, with the relevant construction companies paying royalties to the adjacent customary land owning tribes. As with logging activities, public records of the amount of gravel extracted, and the balance of extraction and deposition is not available. The ESIA notes that a review of the gravel situation in the 2010s found that accessible supplies on Guadalcanal were being depleted. Smaller-scale extraction for local village housebuilding takes place along the river.

Although the TRHDP will act as a barrier to recruitment of sand and gravel to the downstream Ngalimbiu reach, the riverbed downstream of the dam will still have gravel that continues to be transported downstream for many years to come. Therefore there will still be an opportunity for gravel extraction within the Ngalimbiu River. Also, with population growth the supplies of river gravel will remain important for construction of homes and other development projects in the project area and Honiara. The combined effects of the TRHDP and ongoing extraction will see a diminishing supply of aggregates in the river and pressure on alternatives. In the long term, the activity is probably not sustainable. It should be noted that the construction of the TRHDP is not expected to utilise riverbed gravel.

Commercial Developments and New Enterprises

Given the close proximity to Honiara, improved road access and mains electricity supplies, and noting the changes in and along Black Post Road and surrounding areas in recent years, the project area and nearby areas are likely to experience ongoing investment by current and future residents, and outsiders, in a range of commercial and other investments. While some of these changes, such as a recent new hospitality enterprise adjacent to the construction camp, are likely to be a consequence of project planning and construction activity, others are likely to be additional activities.

Agricultural Development

The Solomon Islands Ministry of Agriculture and Livestock has recently announced a sector-wide program to invest in and transform agriculture and livestock farming. Its stated goal is "to improve the livelihood of smallholder farmers in selected commodities through agribusiness partnerships, its related productive infrastructure and improved extension services." This SI Agriculture and Rural Transformation Project (SIART) includes pilot subprojects on the Guadalcanal Plains, possibly at Tenaru, funded by the US through the World Bank. The project is supporting the development of livestock farming, cocoa and other high-value crop production.

Infrastructure Development and Housing

There will be increased use of existing infrastructure and also new infrastructure, which includes new and upgraded roads, water supplies and waste disposal. Potential land use changes will include new housing and associated infrastructure, alongside the TRHDP but not necessarily as a consequence of the TRHDP. These developments are driven by available land and proximity to the Honiara labour and other markets. They include housing and new and expended enterprises.

In addition, the Anglican Church of Melanesia proposes to develop a theological university (John Coleridge Patterson University) on a church-owned site along Black Post Road inland from the Construction Camp to the north of Verakambikambi village. The proposed university is in line with the government's overall policy to strengthen the provision of quality education, including tertiary education. Construction and operation of the university will bring significant additional activity and opportunity to the project area with associated changes in land use, and in the long term could contribute more widely to local social development.

Natural Hazard Events

Recent and future climate events include intense storms and floods experienced in the project area. For example, tropical storm Ita cause considerable damage in the area in 2014, and the 1986 Cyclone Namu floods devastated communities along the Tina/Ngalimbiu river system and caused a major shock to the national economy. In the past, families have relocated from the Weather Coast to northern Guadalcanal due to landslips and related damage due to repeated. storm events. This is likely to happen again in the future.

These types of extreme events will most likely become more frequent and intensify with climate change. The World Bank assessments of climate change vulnerability warn that the Solomon Islands have significant vulnerability to extreme rainfall events and disaster risk reduction is of “critical importance”. At present planning project planning for storm events is focused on design elements and management plans covering likely flood levels and stormwater disposal (C12 and also project design elements in C1).

Flood events and any mitigation efforts such as new flood controls, or any impacts on new community water supplies, could in turn change settlement patterns and affect roads and other infrastructure in addition to the changes from the TRHDP.

B. Details of Cumulative Impact Issues

Water Quality

Water quality for many of the major rivers on Guadalcanal is a major concern for the area's communities, who claim the Matepono River was contaminated by past gold mining operations, especially during rainy seasons, resulting in the loss of livelihoods that are dependent on the river. The construction of TRHDP is a source of concern for downstream communities in the middle and lower reaches of the river catchment due to the additional changes to flow levels at certain times, and perceived and experienced sedimentation and pollution levels affecting water supplies. An important aspect is potential sedimentation and pollution from the use of chemicals during the construction phase of the dam, in particular the use of large quantities of concrete.

Threats to water quality from combined projects or activities and likely future activities in gold mining and, palm oil production has a spatial overlap across the tributaries of the Matepono River and the main stem, along with the headwaters of the Tina and Toni Rivers, which flow into the Ngalimbiu River. In terms of pollution from potential future events, the Gold Ridge tailings dam is an additional potential threat for downstream communities along the Matepono River.

The Gold Ridge mining operations recommencement, and any expansion westward into the Toni/Tina River catchment, would create a spatial overlap with the TRHDP or GPPOL operations. If any of Gold Ridge's mining activities expand to involve tailings works, mine access roads, or overburden spoils dumps within the Toni River catchment during the period of TRHDP construction, cumulative impacts on water quality and suspended sediment loading could occur downstream in the Ngalimbiu River. Additional indirect impacts would then accrue to aquatic habitats, aquatic organisms, and to water users. At present, there is no indication that the mine development would expand into the Toni River drainage.

GPPOL uses herbicides in their extensive oil-palm plantations and there is a risk of cumulative impacts on water quality and aquatic habitats due to their operation, The TRHDP and oil palm industry overlap both spatially and temporally, for potential releases of sediment-laden runoff and contaminants into the Tina and Ngalimbiu rivers during construction of the TRHDP, and herbicide and nutrient containing runoff releases from oil palm plantations into the Ngalimbiu River. However, until sampling data are available on contaminant levels in oil palm plantation drainage waters released into the Ngalimbiu River, it is difficult to assess the magnitude of cumulative impacts to water quality in the lower Ngalimbiu catchment. Notwithstanding, it is anticipated that surface water and sediments in the river will contain traces of the chemicals used on the plantations. During TRHDP construction, sediment-laden runoff draining earthworks could combine with sediment from oil palm fields on days with high rainfall, affecting the Ngalimbiu River and the coastal environment at the mouth.

Additional logging activities are another significant source of impacts on water quality through soil exposure, increased runoff, and soil erosion The TRHDP itself will reduce the area of forest in the project footprint while construction of the access roads will degrade that forest area and make it easier to remove any remaining trees and to access new areas of \ of standing timber. The access roads could therefore increase commercial and artisanal

logging if no formal protection of the Tina River catchment is implemented. Increased logging could contribute to erosion or slope failure and increased suspended sediment loading of the river. If this occurred upstream of the reservoir, it would speed up reservoir sedimentation, and impact aquatic life both in the reservoir and in the river downstream. As documented in the Gold Ridge ESIA, an increase of logging activities occurred as a result of improving road access around the Gold Ridge mine. Slope stability and soil erosion are also likely to occur as a result of intense weather events and floods in the river system.

Regardless of the type of logging activity and whether it is internal to or external to the Project, there will be an aggregating effect of logging along Tina River.

Gravel extraction is also likely to be an important cause of turbidity level in the Ngalimbiu River, causing cumulative impacts on water quality during construction of the dam. Once operating the dam will potentially reduce sedimentation in lower reaches, reducing cumulative sedimentation impacts in the longer term.

As noted in the ESIA and the social-economic monitoring baseline survey, riverside communities use the Tina/Ngalimbiu for bathing, doing laundry, as a source of drinking water, and for toileting. Faecal contamination of the river is an issue for the downstream communities, and with population growth, could worsen. To counter this trend and the attendant health problems, the TRHDP community benefit-sharing programme is installing community water supplies and latrines. For those still reliant on the river additional pollution from multiple sources presents a threat to health, especially of children.

Terrestrial and Aquatic Habitat and Biodiversity Loss

Cumulative impacts of habitat and biodiversity loss also will be potentially significant between the TRHDP and other sources of impact.

Forest will be removed for the access road and the hydropower facilities and a portion of the river system will be impounded to create the reservoir. This is in addition to the significant habitat loss that occurred when the GPPOL operation expanded its production to new “out-growers” who supply oil palm kernels from new satellite plantations, and Gold Ridge prospected onto new sites in central Guadalcanal. This will result in a net loss of habitats and biodiversity. How the combination of the TRHDP and chemical contaminants discharged from the oil palm plantations into the Ngalimbiu River will affect fish and other aquatic life is difficult to assess, since most studies on herbicide toxicity are carried out using organisms that are not present in the Solomon Islands.

The TRHDP dam will act as a barrier to sediment movement from upstream. Without mitigation in the form of periodic replenishment of downstream bed load, there will eventually be a net deficit in the recruitment of sand and gravel into the Ngalimbiu River. Such deficit may eventually lead to river-bank erosion and may impact fish communities that rely on gravel for spawning. However, there is sufficient material present as bed load and on river terraces in the middle and lower reaches of the Tina River to provide for downstream sediment recruitment for many decades to come. Any dewatering, flushing and excavation or dredging of accumulated bed load sediments from the reservoir should further ameliorate any cumulative impacts over this time period.

Land Acquisition and Tenure

A long-term cumulative impact will be the land tenure change from customary land tenure to alienated land that has already occurred in the TRHDP Core Area in addition to the land already alienated to GPPOL for the oil palm plantations, to the former Levers plantations and to Gold Ridge for mine development. In addition will be any other lands in the area that are acquired for any purpose, leading to an ongoing shift from customary tenure.

The process of land tenure alienation sometimes leads to land disputes, although the process followed for TRHDP has averted any serious disagreements. This problem remains prevalent on Guadalcanal with, for example, recent disputes at Gold Ridge. Many of the landowners of the TRHDP area are also landowners at Gold Ridge. The disagreements over land range from land boundaries to royalty payments, access rights, tambu sites and access to developed lands.

Tensions for land acquisition could flair as households, kin groups, tribes and villages attempt to reconcile the customary land ownership with the government's requirement for landowners to be legally registered, so that the developer can gain land access rights. In the process of acquiring land, identifying the lawful landowners is usually difficult, sometimes leading to more conflict in the community, and ongoing tensions within and between tribes and families. Some disputes of land boundaries are many years old and have not been resolved.

Another common source of disputes and disagreement arises over the relative size of royalty payments for land and resource access. Where no clear guidelines and transparency of process is defined, it amounts to continuous tension and disruption of the development activities. This is the experience of both Gold Ridge and GPPOL.

Reclamation of alienated land is among the most challenging land issues in the region, the background of which was the recent civil conflict which in part involved a request for alienated land on Guadalcanal to be returned to indigenous landowners. At Gold Ridge, after the civil conflict, some 400 relocated villagers returned to the mine area. Among them, many did not have recognizable claims to the land.

Employment

Employment is among the most important benefits that all projects have brought to communities and landowners on the Guadalcanal plains and the broader Solomon Islands. The development of the TRHDP means new employment opportunities for communities in the project area directly and indirectly as a result of the project. Much will depend on the success of procurement policies under the ESMPs, which emphasise training and employment of workers from the CBSP area, alongside controls on any influx of job-seeking opportunists from outside the area.

Post-conflict Guadalcanal has also been resistant to allowing workers from other provinces to work on development projects within their province. This is a challenge that GPPOL, Gold Ridge and Lee Kwok Kuen's lower catchment market gardens have had to address when skilled workers were needed.

Employment of non-local workers for jobs that could be done by locals could be a threat to the stability of activities. Gold Ridge's experience with the employment of Fijian security

officers exacerbated tensions and resulted in resentment by the communities within the project area. GPPOL, on the other hand recently employed local contractors to provide security for its operation, which resulted in significant improvement of the company's operations. It reports that all provinces are represented in its current workforce.

In general, further foreign investment and paid employment opportunities (rather than subsistence agriculture) are likely to increase, with the cash economy becoming an increasingly important aspect of local household livelihoods. On the other hand, the Solomon Islands Agriculture and Rural Transformation (ART) programme which is just getting underway is setting out to improve self- reliance and livelihoods security among small-holder farmers – who still make up most of the Malango economy.

Food Security and Sustainable Livelihoods

The combination of developments (hydro, oil palm and mining) could further increase the pressure on food security for many communities around the project site adding to a broad process of social change arising from multiple actions and sources. Many of these communities are already supplying local agricultural produce to the GPPOL and Gold Ridge work forces, and TRHDP is an additional opportunity. The increasing involvement in and dependence on the cash economy will mean that farmers could produce more to meet market demands, which could mean more pressure on local community food security. With the growth of the population, westernisation, and increasing participation in the cash economy, local rural households have become more reliant on imported shop foods such as rice (eaten daily by 94% of households), flour, canned fish, and noodles, along with traditional home-grown root crops and greens.

Developments such as the TRHDP provide opportunities for women to enter the paid workforce and to be involved in the provision of goods and services. The additional income earnt improves food security in their households, especially in time of shocks, as well as bestowing other benefits and opportunities. This change is evident in the TRHDP over recent years. On the other hand, women tend to marry young, carry the burden of household work, and be time-poor, with paid work seemingly leading to decreases in home production of fresh food. Ongoing and additional losses of productive food-growing land, and of food gathered from forested areas, will potentially exacerbate food insecurity, especially among vulnerable households. A reported reluctance by young people to become farmers may also be leading to the cultivation of smaller gardens, and contributing to the increasing consumption of shop foods.

Cultural and Traditional Practices

The added pressure on traditional norms and cultural practices due to the presence of an additional large-scale developments with TRHDP, expansion of present developments, and any new projects and enterprises in the area will most likely result in potential tensions and conflicts within the project area.

Existing internal issues and tensions between communities, tribes and individuals created by activities nearby could combine with any associated with TRHDP and revealed by mechanisms such as the GRM. Also, issues relating to Gold Ridge and the reopening of the

mine and/or its possible expansion, or to the operations of GPPOL, could spill over to the TRHDP due to relationships of kinship and land shared among the people and communities.

The pressures on traditional norms and cultures from the influence of “western” and modern ways, will increase significantly as communities interact with those participating in the development activities. These interactions could be beneficial in terms of cross-cultural interaction but, at other times, will result in strains on project-affected communities. It could be argued that if Gold Ridge had stayed closed, then GPPOL is an example of good practice that TRHDP is following, so the cumulative impact if any is likely to be positive.

Taken together, these modernising influences backed by large financial resources, modern technologies, and sets of administrative skills and political access may be overwhelming for traditional leadership and authority structures in small social groups and hamlets, which, in turn, reduces social cohesion.

Substance Abuse and Increased Crime

Substance abuse and alcohol related abuse are frequent among men working at both GPPOL and Gold Ridge. This issue was frequently raised during the TRHDP Project social surveys, as well as during the February 2014 Mitigation Workshops. The main reason is that some men are unused to regularly receiving a cash salary and do not have the necessary experience to manage their money. Consulted communities fear that the TRHDP will be no exception. This is a challenge that the TRHDP will need to take seriously, to develop appropriate prevention measures and avoid an additional effect in the area. Alcohol and drug abuse result in domestic disputes and issues that threaten peace and harmony within the communities. The experience is that many of the disputes are often started with alcohol or drug abuse. The relatively sudden availability of cash can also result in inappropriate and illegal social behaviour, ranging from petty crimes, extramarital relations, and gambling to criminal related activities, further undermining social cohesion and traditions. With increased paid employment opportunities for local people from future developments, these challenges to social order and wellbeing can be expected to increase unless they are explicitly managed.

Local Amenity, Visual Intrusion and Sense of Place

The Guadalcanal Plains already have experienced a very distinct visual impact due to the presence of oil palm plantations. The GPPOL plantations and the Gold Ridge mining operations are highly visible locally and from a distance. The TRHDP access road and the by-passed river reach will further add significant change to the natural visual amenity of the whole area. Increased heavy and light traffic on arterial and local roads, with associated increases in noise, dust and accidents, can lead to a reduced sense of safety for residents, especially those on foot. The dam and hydropower station will also be distinct features, although they will only be visible to nearby observers, owing to the steep topography. Already at night the GPPOL oil palm and Gold Ridge mine projects emit light that can be seen at a distance, and TRHDP will be an additional light source requiring management strategies. With future developments, such as new gold mining operations and commercial scale logging, such visual changes will alter the landscape and the role it plays in traditional practices and the sense of local identity.

Natural Resources Availability

Developments in the project area have allowed, and will continue to allow local communities to significantly improve the cash employment contribution to livelihoods. Although social challenges, such as land tenure issues and disruption of traditional ways of life, are still present, these projects contribute to positive changes to local communities. These projects also have a downside, insofar as they contribute to increased population, new human settlements and demand for land along with supporting infrastructure, such as tracks, roads and facilities that reduce available natural resources. The projects could therefore, contribute to increased pressure on natural resources such as wildlife, fish, and timber and non-timber forest products. This reduced resource base by population size has potential flow on effects for cultural practices, social life, health and wellbeing.

Increased population will lead to degraded water quality, primarily as measured by turbidity and coliform, and problems of solid waste/garbage disposal. There is also a risk that new residents (some housed informally) will arrive on site and initiate land disputes with local villagers. Human settlement expanding into previously forested areas with houses and new gardens could bring domestic animals that can become feral, and could open the path for invasive species, affecting biodiversity over time.

Natural Hazards and Dam Safety

Community consultations have indicated a concern for dam safety, particularly catastrophic dam failure that could send a wave surging down the Tina River valley, destroying homes and taking lives as it inundated villages. Local communities have had experience of massive flooding and landslips from cyclones, including deadly Cyclone Namu in the 1980s that swept away many settlements along the rivers and on the plains.

The primary activity that would combine with the TRHDP to create cumulative impacts is increased precipitation from climate change along with timber harvesting in the upper and middle catchment area of the Tina River. The concern is related to commercial clear-cutting, as opposed to selected harvesting as it is currently carried out in the middle reaches of the catchment. Clear-cutting on steep slopes could expose fragile soils, destabilise slopes, and result in flooding, landslides and debris flows of slash that could endanger the dam and reservoir, as well as cause flash floods and road and bridge washouts downstream. This effect has been seen in recent years in other catchments in northern Guadalcanal. If commercial timber harvesting were prohibited in the catchment upstream of the dam, the potential cumulative impact would be reduced. Commercial timber felling of sloped land above 400m is currently not permitted under the legislation (Forest Resources and Timber Utilisation Act). Where this law is enforced, it will prevent commercial logging over the vast majority of the upper catchment area.